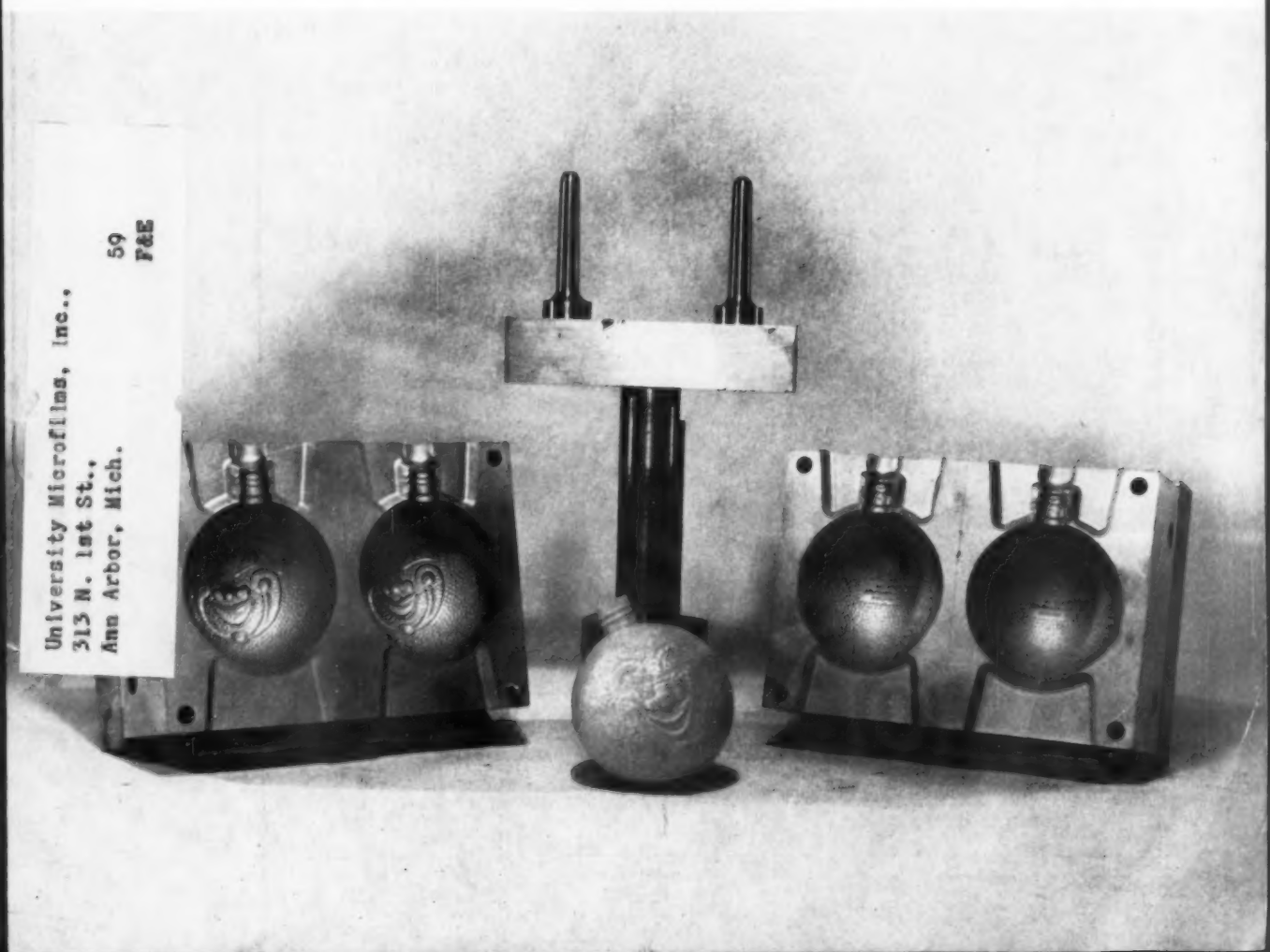
JULY 1960

PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

Blow molding fundamentals
Rigid polyethylene extrusion
Plastic material developments



University Microfilms, Inc.,
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59
P&E

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Mark 33 gives exceptional long-term heat stability in rigids. It is recommended for pigmented or darker stocks. *Mark 34* is recommended where crisp, initial color is required, and provides good clarity. *Mark 35* gives better initial color than Mark 33, and longer stability than Mark 34.

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PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

July 1960, Vol. 6, No. 7

feature article:

blow-molding—1. fundamentals ..... p. 31

by ISLYN THOMAS and N. F. HARWOOD

The start of an authoritative, six-part article. This section describes the interest evoked by blow-molding, its current status, and its outlook for the future—with special note of its applications. In discussing production processes, injection blow molding and extrusion blow molding are emphasized. Extrusion blowing machinery is discussed, with special attention being given to various machinery models, their advantages and limitations; die head designs; blowing molds; and the first mention of two-color blow molding. Future sections will deal with product design for blow molding, mold design, parison considerations, die-head design, and two-color blow molding.

feed-screw design for extruding rigid polyethylene ..... p. 39

by WALTER MUNDY and A. L. WALTERS

With the introduction of linear polyethylenes, the need for investigating some of the newer extrusion feed-screws became evident and imperative. A test program was set up to test screw designs for use with Marlex 6002 resin. Preliminary results are given, and it is suggested that this work be extended by others in the plastics industry to give similar results for other rigid polyethylenes.

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the plastics technical evaluation center—a new project and a new concept ..... p. 42

by H. E. PEBLY, JR.

advances in the technology of plastics:

advances in phenolic materials and processes during 1959 ..... p. 41

by A. P. LANDALL

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When quality is more important than price!

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Do you remember those "Good Old Days"?

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Cover photo courtesy:
Newark Plastics Machinery Corp.

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Letters to the Editor

Admiration Plastics Rulers

Dear Sirs:

We note the letter in the March issue (page 4) asking if you could give the name of the manufacturer of the plastic ruler with the trade name "Admiration."

This is to advise that Commonwealth Plastics has purchased the entire line of Admiration molds from Northeastern Plastics of Boston. Northeastern was one of the original manufacturers of plastic school supplies, and the name Admiration has been before the public for many years. At the present time, we are expanding this line with the addition of a number of new items that will go to the school and stationery trade.

We are contacting the Canadian outfit direct. Thank you for publishing their letter in your magazine.

M. F. Levine, Vice Pres.
Commonwealth Plastics Corp.
Leominster, Mass.

Thank You Note

Dear Sirs:

This letter is to express my appreciation for the courtesy extended me by your Reader Service Department. The courtesy and promptness my phone request for the 1958 and 1959 volume indexes received was amazing in light of my recent experiences with several other publications.

My compliments and sincere thanks to you and your Reader Service Department.

J. U. Venaglia
West New York, N. J.

Miniature Plastic Ships

Dear Sirs:

I am interested in locating a manufacturer of miniature plastic ships. These ships should be about 1½-4 inches in length and be replicas of navy submarines, destroyers, aircraft carriers, battleships, etc.

E. J. Yeager
Cincinnati, Ohio

(Possible suppliers of the items in question would be Pyro Plastics, Union, N. J.; Lus-Trus Corp., Ypsilanti, Mich.; and Rosbro Plastics Corp., Pawtucket, R. I.—to mention only a few.—Editors)

Information Wanted

Plastic Stationery Racks

Dear Sirs:

We are endeavoring to develop a source of supply of plastic stationery racks complete with partitions which can be inserted in office desk drawers for storing stationery.

John Zuris, Purch. Agent
Standard Furniture Co.
Herkimer, N. Y.

(Readers are invited to either write directly to this company, or to this office for transmittal to the inquirer.—Editor)

Special Plastic Boxes

Dear Sirs:

We are trying to find boxes to store samples of wood. They should be made of a clear plastic without any plasticizer which might affect the wood. We have in mind something fairly rigid like polystyrene, but something partly flexible would be satisfactory.

The wood samples are about four inches square, and vary in thickness from about ⅛ to about ¼-inch. We have in mind a simple box consisting of a bottom and a cover with walls about 1/16-inch thick. For convenience, we have summarized the dimensions we want, as follows: Inside—4 x 4 x 3/16-inch (bottom), and 4⅛ x 4⅛ x ¼-inch (top); Outside—4⅛ x 4⅛ x ¼-inch (bottom), and 4¼ x 4¼ x 5/16-inch (top). However, we are subject to change, if necessary, to conform with some standard size already available.

(Identity Withheld)

(Any replies received will be forwarded to the inquirer.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

In the Next Issue

The August issue will feature the following articles:

Improved Techniques for Extrusion of "Teflon" 100-FEP Fluorocarbon Resin. J. A. Blair and H. J. Haon III, Sales Technologists, Polychemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

Production rates for smooth-surfaced wire coatings made by extruding this new modified Teflon resin go far beyond those previously possible for the original resin. At speeds higher than 300-600 feet per minute, melt fracture of the resin causes roughness because of excessive shearing of the resin as it passes through the extrusion die. This can be eliminated by increasing the die opening or lowering the resin viscosity by keeping the resin as hot as possible.

•

Rockwell Hardness Scale Comparison. Charles Andrews, Laboratory Mgr., Chicago Molded Products Corp., Chicago, Ill.

An investigation of Rockwell hardness tests and hardness scales for plastics materials provides data of benefit in an over-all picture of plastics hardness. A chart is given that can be used for quick comparison of different Rockwell hardnesses that are used currently for plastics materials for use in evaluation and design.

•

A New Weathering Stabilizer for Poly (Vinyl Chloride) Plastic. H. W. Coover, Jr., Research Assoc., R. L. McConnell, Sr. Research Chem., G. C. Newland, Research Chem., and J. W. Tamblyn, Research Assoc., Tennessee Eastman Co., Kingsport, Tenn.

Test results show that HPT is a light stabilizer of the type needed for thin films and fibers. Care is required in formulations to retain adequate heat stability by assuring that the stabilizer disposes absorbed energy in a manner that is completely harmless to the surrounding polymer molecules.

•

Long-Term Durabilities of Polyesters in Glass-Reinforced Parts. A. L. Smith, Head, and J. R. Lowry, Staff Member, Development & Appls. Lab. for Reinforced Plastics, Rohm & Haas Co., Bristol, Pa.

Long-term exposure tests of up to five years have demonstrated the superiority of the firm's acrylic-polyester over straight 100% acrylics in glass-reinforced constructions. Many experimental test results, plus actual exposure test installations are given in substantiation. This apparently anomalous behavior is analyzed carefully and explained.

•

The **Guest Editorial** will be "Industrial Design and the Battle for Material Supremacy," by D. E. Scott, Staff Designer, Sundberg-Ferar, Inc., Detroit, Mich.

IF PHENOLICS CAN DO IT, PLENCO CAN PROVIDE IT . . . AND DOES . . .
FOR THE HARMONY COMPANY

new music-making DUO!

the modern banjo by Harmony

and

plenco

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The old-time minstrels didn't know what they were missing. No question that Mr. Bones & Co. could make a banjo sing and ring with a beat perhaps no one today can duplicate. Today's better banjos, however—like the new 4- and 5-string instruments developed by The Harmony Company, Chicago—have qualities even the greatest of the old-timers would have appreciated.

Advanced, professional-type Harmony banjos utilize modernized banjo construction. A new, solid, non-warping "Reso-Tone" rim and resonator molded of Plenco Phenolic Compound 345 Oak Mottle helps assure superior tone and powerful banjo "ring and snap." The tone is amazing, say professional artists.

This Plenco material offers Harmony properties of excellent stability as well as fast cure, smooth mottle-pattern finish, good impact characteristics, and tensile strength. It's one of a series of formulations use-proved, notably, in the manufacture of radio and television cabinets. A wide variety of Plenco phenolic compounds—*ready-made or specially-made*—is available for general and special-purpose applications in *all* industries. They could add new "ring and snap" to your own product, new ease and economy to your production. We'd like to show you.

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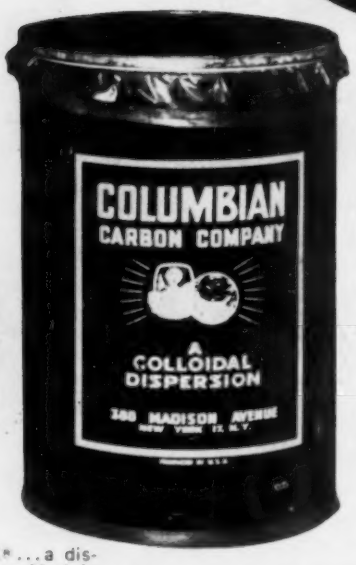
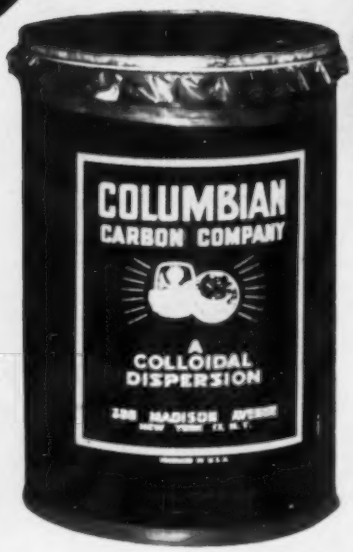


COVINYLBLAK®...a dispersion of carbon black in vinyl resin—chip form.



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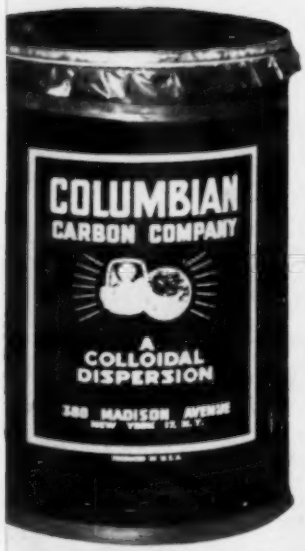

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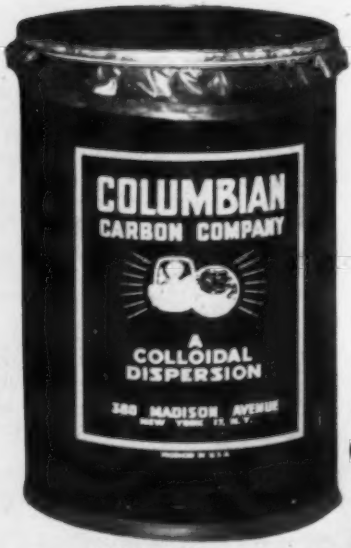
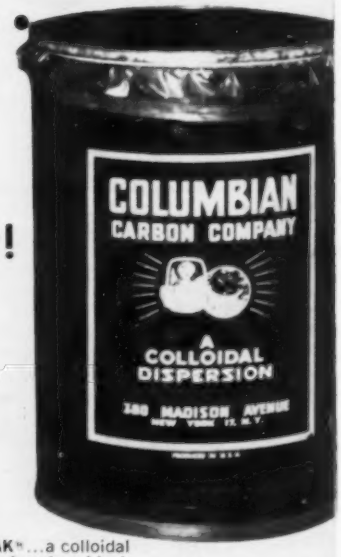


AQUABLAKS®...water dispersions of carbon black for integral dyeing of synthetic fibers.



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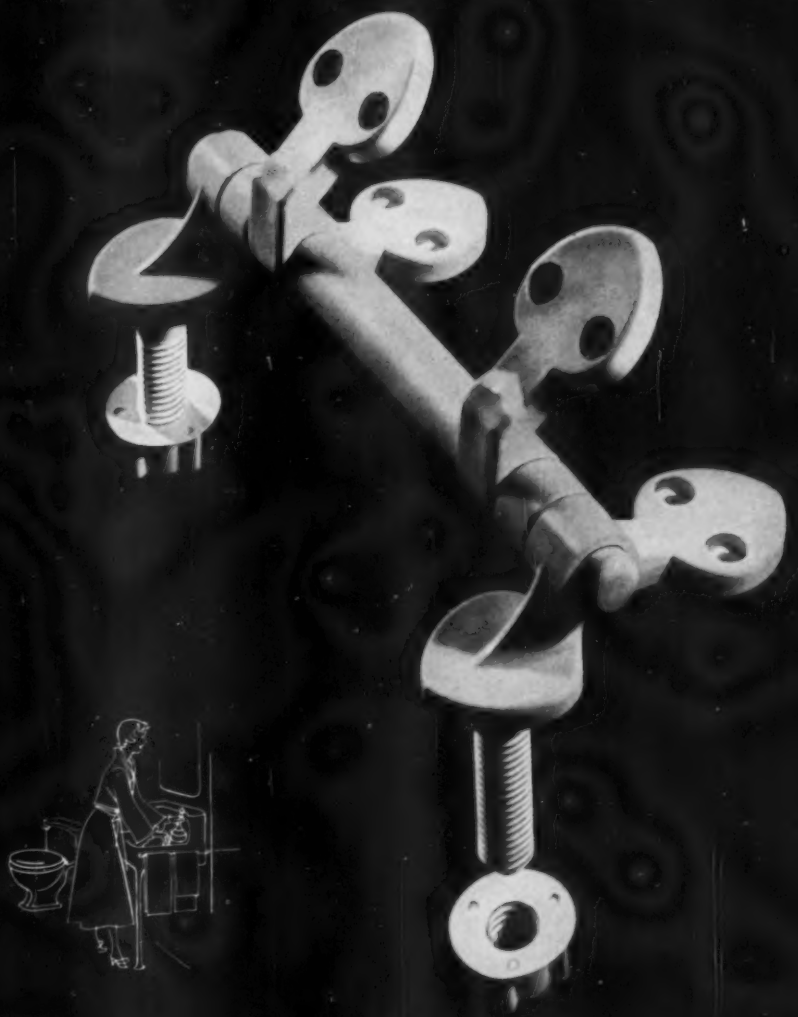

Hinge for Century seat eliminates metal

The Century hinge is designed for long, trouble-free service. It is an important quality feature of the deluxe toilet seat design. Molded of Fortiflex linear polyethylene, *the hinge has no metal parts . . .* is corrosion-free and can be cleaned with boiling water. It has a smooth, lustrous surface that is mildew proof. The low coefficient of friction of the material makes the hinge "self-lubricating."

Fortiflex is an easily molded, tough, rigid design material. An economical plastic, it can often replace metals and other materials in your design, with savings.

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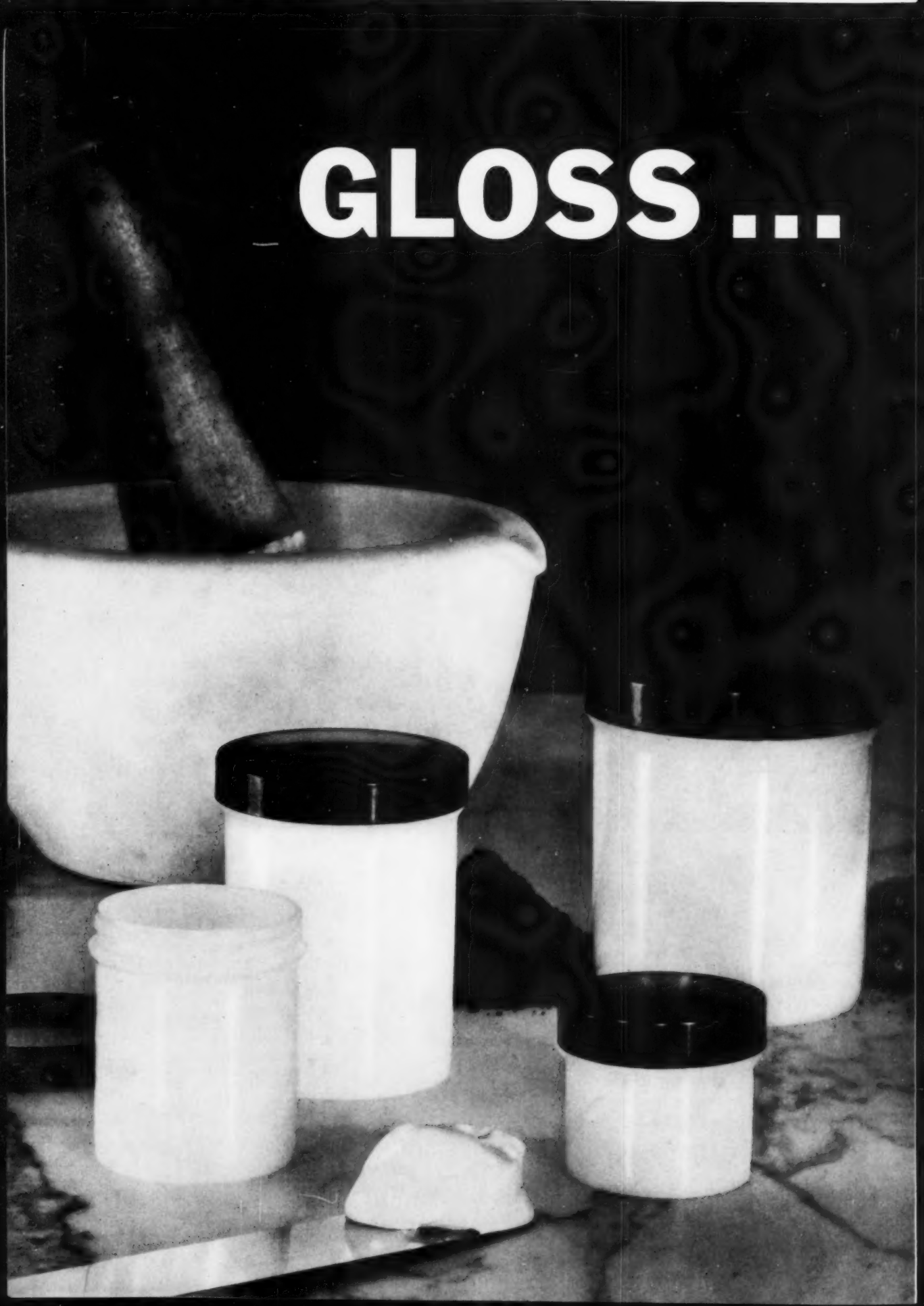
GLOSS...

...another way high-density polyethylene IMPROVES YOUR PRODUCT

A STRIKING APPEARANCE can lend considerable appeal to any product. These injection-molded stock jars show how it's possible—with the gloss and luster provided by BAKELITE Brand high-density polyethylene DMD-7000. Gloss is just one of *many* sales points for products made of high-density polyethylene.

Exceptional toughness, rigidity, and dimensional stability are additional advantages of DMD-7000 which are found in these jars. They'll take extraordinary abuse in handling and shipping, and still hold their exact shape. Highly chemical resistant, they're unaffected by corrosive contents—a factor that broadens their usefulness. And with only one-fifth the weight of glass, these high-density polyethylene jars result in a substantial saving in shipping cost.

You can look for improvements like these when you specify BAKELITE Brand polyethylene. Select from the wide range of polyethylenes available to get the best combination of properties for your product. Besides the low, medium, and high density types, investigate the new polyethylene copolymers, notable for exceptional toughness, stress-cracking resistance, and long flex life.

Call on our technical knowledge and plastics experience to aid in applying these materials to your product. Mail the coupon today, or write a description of your requirements directly to Dept. BT-105, Union Carbide Plastics Company, Division of Union Carbide Corporation.

TYPICAL PROPERTIES OF DMD-7000

Properties	ASTM Test	Typical Value
Density, gm/cc	D 792	0.96
Melt Index, gm/10 min.	D 1238	5.0
No-Load Heat Distortion Temperature*		130°C. (266°F.)
Secant Modulus (stiffness), psi	D 638	150,000
Tensile strength, psi	D 638	4600
Ultimate Elongation, %	D 638	15
Durometer Hardness "D"	D 1484	65

*Obtained on injection molded specimens

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UNION CARBIDE

These stock jars, made by Celluplastic Corporation, Newark, N. J. display the high degree of gloss available in products molded of BAKELITE high-density polyethylene DMD-7000.

Dept. BT-105
Union Carbide Plastics Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N.Y.

Please send me information on BAKELITE Brand high-density polyethylenes with particular emphasis on these properties .....
the application being considered is .....

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Firm name_____

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PARAPLEX G-60 and G-62...the first oil epoxide vinyl plasticizers accepted for food packaging

PARAPLEX G-60 and G-62 have been widely used in vinyl film for packaging for nearly five years, and were originally accepted by the Food and Drug Administration and the Meat Inspection Branch, Department of Agriculture for food packaging on the basis of a two-year series of extensive feeding tests conducted at the Medical College of Virginia.

Film plasticized with PARAPLEX G-60 and PARAPLEX G-62 is ideal for packaging almost all foods, including meats, lard, fats and oil-containing foods which may tend to leach out less permanent plasticizers. In addition, very low levels of taste and odor make these plasticizers ideal for vinyl packaging materials used in preparing foods for storage.

Resistance to discoloration in high temperature vinyl processing is another benefit of the extreme stability of PARAPLEX G-60 and PARAPLEX G-62. Write for complete processing information and a description of feeding tests made for food packaging approval.

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THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

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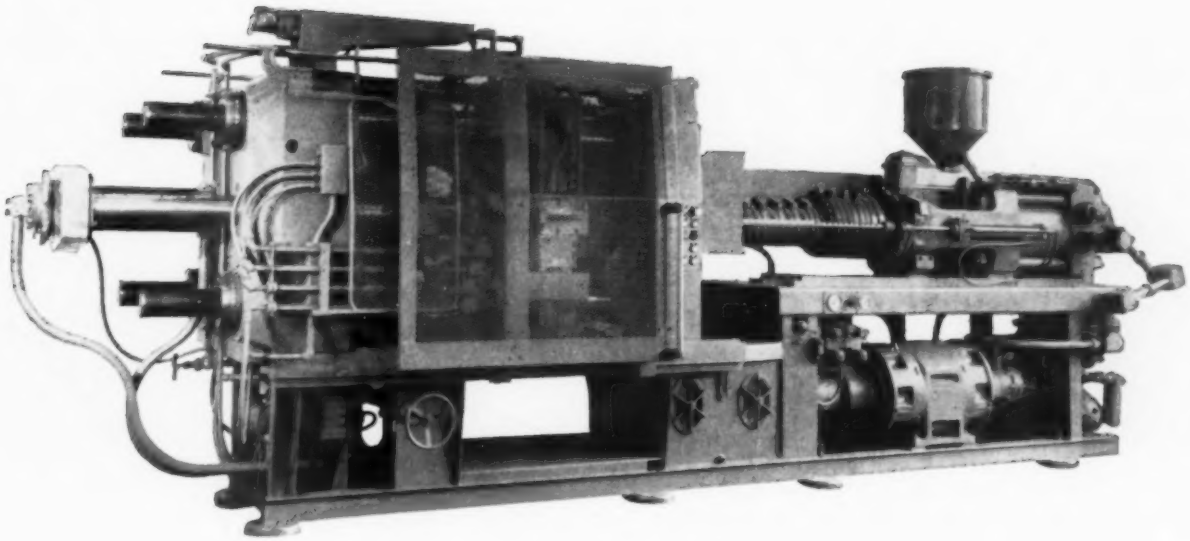
Injection Molding's Most Versatile Performer!



Impco Model HA16–425

20 ounce injection molding machine

The size of the new HA16-425 "Impco", combined with its speed and adaptability, make it Injection Molding's most versatile performer! Seven hundred and twenty dry cycles per hour at full 24½ inch stroke — two hundred pounds per hour plasticizing capacity — hydraulic knockout — live adjustments, are but a few of the many features contained in this machine. Let us show it to you.

IMPCO®

IMPROVED MACHINERY INC.

NASHUA, NEW HAMPSHIRE

In Canada, Sherbrooke Machineries Limited, Sherbrooke, Quebec

Export Distributors: Omni Products Corp., 460 Fourth Avenue, New York, New York

This Month in Brief

The Editorial this month discusses the subject of foreign competition, and urges that it be met by making better plastics products and using better production methods, not by import restrictions or by cheapening domestic products to meet foreign price levels.

This month's Guest Editorial deals with the PTEC, the Plastics Technical Evaluation Center recently set up at Picatinny Arsenal. Written by its Director, H. E. Prebley, Jr., the editorial discusses the functions of the new Center, and what it expects to accomplish to assist the domestic plastics industry by accumulating, evaluating, and disseminating engineering data on the different plastics materials.

"Standardization" is the subject of the engineering section, "Exploring Fabrication Techniques." Our Engineering Editor notes that "what's in it for me" is the question most frequently asked by machinery builders when faced with hard competition. This results in a re-evaluation of production costs and brainstorming sessions where uncensored thinking is encouraged. These sessions generally show that standardization gives smaller storage inventories, lower costs through quantity purchasing, simplified buying, and a reduction in man-hours of work.

Some notes on the Feature Articles in this issue follow:

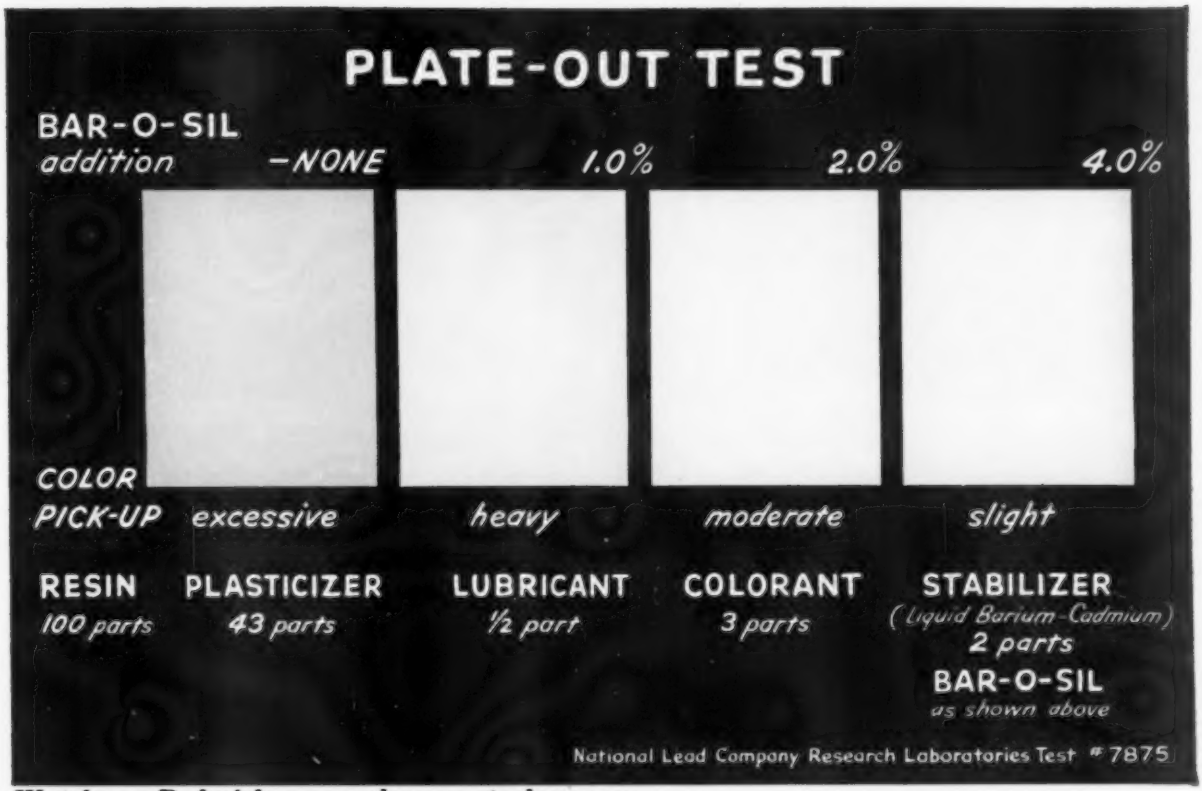
"Blow Molding - 1. Fundamentals", the lead article, begins an authoritative series that will consist of six parts. This first part discusses the current status and outlook for the future of this newest processing field. Special attention is given to machinery models for injection and extrusion blow molding, as well as machine components.

"A Feed-Screw Design for Extruding Rigid Polyethylene" describes an investigation of some of the newer feed screws. Preliminary results are given, and it is suggested that this work be extended by others to obtain similar results for the various rigid polyethylene materials.

"Advances in Phenolic Materials and Processes During 1959", an article in the current series on Advances in the Technology of Plastics, notes the large advance in phenolic production that took place last year.

"Advances in Plastics Materials, 1959-1960", another Advances article, covers developments in plastics materials available to processors that were announced during the past 18 months.

Two Engineering Forum columns this month: Reinforced Plastics, and Compression & Transfer Molding. The former looks back "nostalgically" to the 'good old days' in reinforced plastics, making it evident that the old days luckily have been outmoded by all the materials and techniques that are used today. The latter describes how quality is more important than price in meeting requirements for missile and rocket insulation-liner parts that must meet rigid purchase specifications, and gives bench-marks for setting up your own quality-control program to insure acceptance of your moldings.



Watchung Red pick-up on cleanup stock proves...

novel new supplementary stabilizer gives best-yet control of plate-out

No need to change barium-cadmium stabilization base!

There is a standard vinyl industry test of plate-out. Recently, at National Lead Laboratories, we used it to evaluate a new and novel approach to the control of plate-out . . . with gratifying results.

Test procedure was simple. BAR-O-SIL*, a newly developed National Lead barium-silicate supplementary stabilizer, was added in varying quantities to a number of different barium-cadmium-stabilized stocks heavily overloaded with Watchung Red. Immediately after calendering each sample, a cleanup compound was run. Degree of color pick-up indicates degree of plate-out control established by given levels of BAR-O-SIL stabilizer content. In our many tests, the reduction of color pick-up has always been proportional, depending on extent of plating initially present.

Stop one production run, start the next...in minutes without cleanup

As you can see, BAR-O-SIL stabilizer provides an interesting new tool for plate-out control in barium-cadmium-stabilized stocks. Now it's practical to run color after color in quick succession.

Best of all, this unique supplementary stabilizer provides plate-out control without affecting proven (or new) stabilizations, without altering sensitive colorants, and without increasing yellowing or susceptibility to staining.

BAR-O-SIL stabilizer has several additional desirable effects . . . adds heat stability; sharply reduces hazing, crocking, spewing; controls migration of plasticizer. In calendered products, it imparts a very pleasing dry hand.

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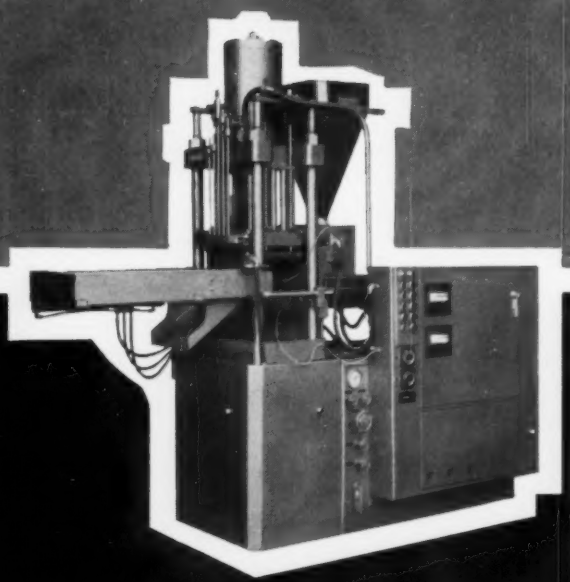

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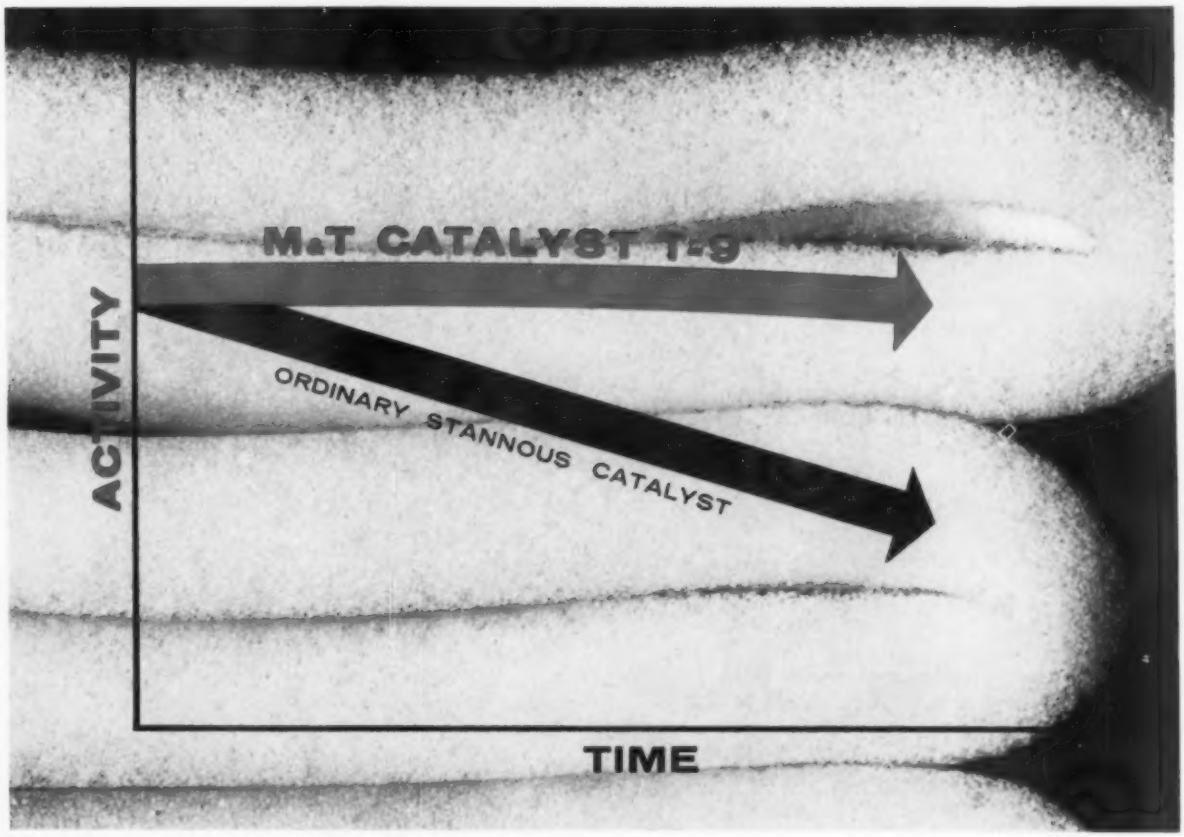

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Close-up of drop door fully opened. Hinged door swings up into chamber to close. Operation causes little or no wear at points of seal, minimizing maintenance.

What's new in processing

Cold welding of plastic films and synthetic fabrics with high-frequency sound waves—a development of Ultrasonic Industries, Inc. The technique involves use of an ultrasonic oscillator which feeds 40,000 cycle/sec. current to a special transducer resembling an oversized ball point pen. The transducer focuses the energy at its tip which is guided across the material being sealed. High frequency sound waves cause a high-strength interlocking of surface molecules, and absence of heat prevents distortion. The transducer can be hand manipulated, or mounted in a fixture for automatic sealing. Ultrasonic has set up a subsidiary company, Sonadyne Corp., to make and market the device which is called the Sewnar.

Tensile strengths of foundry shell cores and molds can be upped as much as 55% with an additive (0.2% by weight of sand) called Nuodex Sand-Plus, a product of Heyden Newport Chemical Corp. A fine powder especially developed for use with alcohol-soluble thermosetting resins, it is mixed with the sand along with a curing agent, hexamethylenetetramine.

Contropress—a system for continuous roll lamination of Videne polyester film to a wide range of raw base panels, developed by Goodyear Tire & Rubber Co. The panels are brushed clean, sealed, and the Videne is applied before finishing or embossing. Contropress pre-finishes panels up to 54 inches in width, and has a capacity of 10-30 lineal ft./min. Film surface can be varied within a range of 1.5-7 mils.

Lower prices for polycarbonate resins—about 35%—should interest thermoplastic processors. Both G-E's Lexan and Mobay's Merlon now run about $1.50 per pound (10,000 lbs.), bulk, in natural color, and the bulk price for stock and custom colors is $1.75.

Abstracts

"Vacuum Hopper Extrusion" appeared in the April issue of Modern Plastics. Using a vacuum hopper, non-porous dry-blend extrusions can be obtained, along with improved surface appearance and physicals.

"Do's and Dont's for Fabricating Laminates" appeared in the same issue, covering cloth-, paper-, and glass-reinforced laminates with special emphasis on tooling.

"A New Approach to Precision Molding" ran in MP for May. It stressed the importance of both mold and runner design.

"The Injection Molding of High Density Polyethylene" by D. G. Briers and D. Burgess is a two-part article, March and April, which appeared in British Plastics. Part I described mold design, Part II covered molding technique.

"Moldability and Solidification of Thermosetting Material" by A. Lundborg appeared in the April issue of Kunststoffe. Flow behavior and setting time influence hardness and therefore determine material choice and processing technique. This can be controlled according to a normal distribution curve.

Patents

2,887,728 to Reflin Co.—a method for casting pipe centrifugally using thermoplastic and thermosetting resins. Coated thermoplastic particles are dispersed in a thermosetting resin of a different specific gravity. This is introduced into a cylindrical mold and centrifuged to yield a partially separated thermoplastic layer constituting one wall of the pipe.

2,888,042 to Resistoflex Corp.—a method of making reinforced polytetra-fluoroethylene pipe. PTFE lining is sintered to unfused, paste-extruded PTFE laminated with a reinforcing layer consisting of reinforcing glass fabric pre-impregnated with PTFE.

2,885,738 to Western Electric Co.—methods of absorbing and retaining expanding media in plastic materials. Thermoplastic granules are added to a liquefied, normally gaseous expanding medium, heated, cooled, and introduced into an extrusion cylinder. This mixture is extruded over a continuously advancing core.

3 WAY SAVINGS

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Exploded View Showing Unassembled Mold Base

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EXTRUDERS—AUXILIARY EQUIPMENT ISSUE

The September issue of Plastics Technology will carry the exclusive, annual tabulation of the latest data on extruders, blow-molding machines and auxiliary equipment.

In addition, there will be these exciting editorial features:

Fixed Orifice Pressure Control for Extruders by Bruce Maddock of Union Carbide Plastics Co.

An article on blow molding by T. C. Broadwell of Dow Chemical Co.

Determining Costs in Blow Molding & Molding Shops by D. Dearle of North & Judd Mfg. Co.

Plus other articles of value to **you.**

Don't miss Plastics Technology's September issue.

PLASTICS TECHNOLOGY
630 Third Avenue
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DOW Plastiatrics
DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

CALCULATING CREEP AND STRESS RELAXATION FROM LONG-TERM DATA

For design engineers concerned with calculating the effects of stress and strain on plastics materials, particularly in designing for long-term applications, the Equations of State (Fig. 1) permit good approximations, to which, of course, will be added a reasonable safety factor.

Obviously, long-term strength data must be used in the equations, since short-term or elastic data do not correlate with long-term service. For example, in designing plastic lawnmower wheels, data obtained over a five-year period would normally be used because this period of time corresponds to a reasonable service life for this type of part. Below are examples of calculating stress, strain and the modulus of elasticity, using long-term data from Fig. 2. These are simple situations. Often shock, high temperatures or other environmental factors must also be taken into consideration.

Example I: A tensile stress of 1000 psi will be applied to a part made of Tyril 767. How much creep will occur during the first six months (4320 hours)? From Fig. 2, the Apparent Modulus at six months is 420,000 psi. Using Equation 2a (Tension):

$$E=\frac{S}{\epsilon} \text{ and } \epsilon=\frac{S}{E}\text{. Then } \epsilon=\frac{1,000}{420,000}=0.0024\text{, or } 0.24\% \text{ elongation.}$$

Example II: Where a known strain is placed on a part, such as a bottle closure, calculate the remaining stress (resistance) after one year. Assume the strain to be 0.42%. Apparent Modulus of Tyril 767 after one year is 380,000 psi.

$$S=E\,\epsilon=(380{,}000)\,(0.0042)=1590 \text{ psi remaining.}$$

Example III: Creep is important in designing webbing and cloth from plastic monofilament. From Fig. 2, Apparent Modulus of Dow saran monofilament after 1½ years is 70,500 psi. Under a stress of 1000 psi, creep is then:

$$\epsilon=\frac{S}{E}=\frac{1000}{70{,}500}=0.0142 \text{ in./inch, or } 1.42\% \text{ elongation.}$$

Example IV: In a hypothetical filter sump for a home water system, the filter must last five years, and operate at a maximum internal pressure of 75 psi. To insure a sufficient O-ring seal, total radial deformation of the sump must be less than 0.007 in., to prevent leakage. Tyril 767 has good long-term strength, ease of fabrication and low cost. Will it be satisfactory for this use? The design strength of Tyril 767 is 980 psi (from Fig. 2) over a period of five years (43,800 hours). From the following formula, solve for "P" (maximum allowable operating pressure).

$$P=\frac{S\left[r^2(b^2-a^2)\right]}{a^2(b^2+r^2)}=120 \text{ psi.}$$

Where: a=Inner radius=2.05 in.
b=Outer radius=2.30 in.
r=Normal radius=2.175 in.
v=Poisson's Ratio=0.035
Δa=Change of inner radius, in.
S=(design) Hoop Stress, psi
P=(maximum allowable operating) Pressure, psi.

Thus, the maximum allowable operating pressure for Tyril 767 is well above the operational maximum encountered in the water system. To determine total radial change of the O-ring:

$$\Delta a=P\,\frac{a}{E}\left[\frac{b^2+a^2}{b^2-a^2}-v\left(\frac{a^2}{b^2-a^2}\right)-1\right]=0.00225 \text{ inch.}$$

Not only is the five-year design strength of Tyril 767 adequate for this application, but it provides a safety factor of 1.6 for operating pressure, and of 3 for the O-ring seal.

Many long-term data of the type used in the examples above, are being developed by Dow Plastics Technical Service Engineers for use by plastics engineers and designers. Such continuing Plastiatrics studies provide not only properties data, but also information on improved methods of design, molding and finishing of plastics. For more detailed information on these studies, write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 1801DT7.

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Zerlon®	PVC Resins
Ethocel®	Pelaspan®
Tyril®	Saran

EQUATIONS OF STATE

1. To calculate simple stresses
(a) Stress in Tension: or in Compression
$S=\frac{P}{A}$ P = Applied load
A = Cross-sectional area of the part
(b) Stress in Flexure (rectangular beam)
(A) Simple support, center loading
$S=\frac{3PL}{2bd^2}$ P = Applied load
L = Distance between supports
b = Width of beam
d = Depth of beam
(B) Simple support, uniform loading
$S=\frac{3PL}{4bd^2}$
(C) Cantilever beam, end loading
S max. $=\frac{6PL}{bd^2}$ P = Applied load
L = Distance from load to support
b = Width of beam
d = Depth of beam
(D) Cantilever beam, uniform loading
S max. $=\frac{3PL}{bd^2}$
2. To calculate modulus of elasticity in the above examples.
(a) Modulus in Tension; or in Compression
$E=\frac{S}{\epsilon}$ S = Stress
ε = Strain
(b) Modulus in flexure
(A) Simple support, center loading
$E=\frac{Lm}{4bd^3}$ m = initial slope of flexure curve
(B) Simple support, uniform loading
$E=\frac{5Lm}{32bd^3}$
(C) Cantilever beam, end loading
$E=\frac{4Lm}{bd^3}$
(D) Cantilever beam, uniform loading
$E=\frac{5Lm}{8bd^3}$

FIG. 1

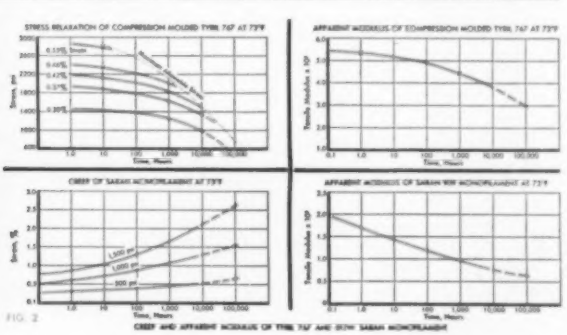
STRESS RELAXATION OF COMPRESSION MOLDED TYRIL 767 AT 73°F
APPARENT MODULUS OF COMPRESSION MOLDED TYRIL 767 AT 73°F
CREEP OF SARAN MONOFILAMENT AT 73°F
APPARENT MODULUS OF SARAN WEB MONOFILAMENT AT 73°F
Time, Hours
Strain, %
Tensile Modulus x 10³

FIG. 2

CREEP AND APPARENT MODULUS OF TYRIL 767 AND DOW SARAN MONOFILAMENT

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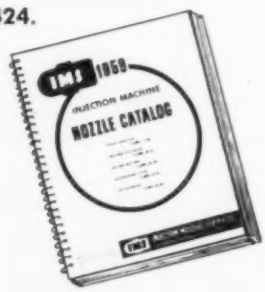


Injection Molders Supply Co.

3514 Lee Road WYoming 1-1424 Cleveland 20, Ohio

U.S.I. POLYETHYLENE NEWS

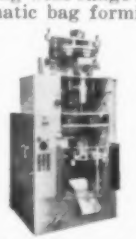
A series of advertisements for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

Packaging Notes

Lamination of 300-gauge cellophane and 2-mil polyethylene is used for low-cost, single-use package that is both a container for two aspirin tablets and a drinking cup. Heat sealing divides the package into its two compartments – upper for tablets, lower for drinking cup. It has a tear opening.

Polyethylene shower caps that double as a carrying case for damp swim suits, cosmetics and other small articles are being supplied by hotels and motels as a complimentary convenience item for guests. They can be printed with a stock or special merchandising message.

A new machine offering wide range size and high-speed automatic bag forming, filling and sealing, has recently been announced. The machine is said to be especially adapted to pouch packaging of frozen vegetables and candy products in polyethylene. It forms bags from 3" to 15" long and 2" to 8½" wide at a maximum rate of 75 per minute. Changing bag size is said to require less than 15 minutes.



Special laminates of thin aluminum foil glue-bonded to paper, with a polyethylene coating on the foil or paper, have been developed by an English company to protect phonograph records from warping when shipped in hot and humid climates. Bags made of these materials are superior to polyethylene bags alone, which, although fine for temperate conditions, may be inadequate for tropical areas because of moisture vapor penetration.

The bags are produced by folding a section of laminate in half, heat sealing the sides, inserting the record and sealing the opening. The metallic or paper outside can be printed, or the moisture-protective bag inserted into a printed over-wrap polyethylene bag.

Miniature polyethylene containers, with a hinged shaker cap permitting one-hand opening and closing, are now being used for salt and pepper–at a cost equivalent to that of paper. Body, shaker cap and lid with interlocking nib are injection molded in one piece. Bottom of the 1⅜" container is foil-laminated disk. Filling rate, controlled by printing speed, is 200 units per minute. The containers are sold in stores in tray packs of six for salt, three for pepper.

Consumers Prefer Polyethylene Wrap For Dry Cleaning and Laundry

Appeals of Flexible Containers Also Listed in Consumer Survey

In a recent survey, consumers showed a marked preference for polyethylene laundry and dry cleaning wraps; said "noiselessness", transparency, break resistance and light weight are the most appealing properties of flexible polyethylene plastic containers; and listed book covers, packaging for liquids and toothpaste tubes as the leading items "which should be made of plastic".

The survey, conducted by a market research company for U.S.I., queried a 1,300-member consumer panel to determine how they felt about polyethylene products and why. The panelists represent a cross section of consumers in seventeen major cities from coast to coast.

72% for Polyethylene

According to the survey, 72% of the panel preferred their dry cleaning and laundry wrapped in polyethylene film rather than in other wraps. High on the list of reasons for this preference to polyethylene wrap is transparency, closely followed by protection against dust and water. Other advantages cited over competitive wrapping materials are ease of storage, strength, and better appearance.

U.S.I. further learned that 70% of the participants in the survey receive their dry cleaning and laundry in polyethylene. This indicates that consumer preference for polyethylene is actually somewhat greater than the polyethylene wrapping service now being offered by cleaners and laundries.

Squeezable Over Rigid

In selecting the most appealing aspects of flexible polyethylene containers, 79% of the panelists mentioned the "noiselessness" of such containers as the basis for preference over the same item made of rigid plastic. Other scores in favor of polyethylene were: transparency 71%; break resistance 66%; and light weight 52%.

The choice of "noiselessness" as the leading property is significant in designing products to be used in hospitals, rest homes and private dwellings. Applications such as garbage cans and most houseware items are in this category.

Transparency, protection from dust and water, ease of storage, strength, better appearance, were reasons respondents to survey gave for preferring their cleaning and laundry packaged in polyethylene.

New Plastics Uses

Many of the suggestions consumers gave for items they'd like to see made of plastic can be, or already are being made of polyethylene, either alone or in combination with other materials. Examples are jelly containers, household cleaner bottles, toothpaste tubes and bread wrap. The latter use has caught on rapidly with bakers and offers, according to U.S.I. estimates, a 60 million pound potential to film producers in five years. Among other items listed were packages for liquids, milk carton coating, and thread spools. Of these, polyethylene for coating milk cartons alone represents a potential market for 110 million pounds of polyethylene.

The wide range of these survey suggestions indicates an awareness by consumers of the role of plastics in daily life and their value in improving familiar household products.

Hospitals Fight Cross-Infection With Polyethylene-Coated Bags

Bags with a polyethylene-coated inner ply are being used in key locations in a paper and sack holder disposal system being installed in a number of hospitals in Great Britain. The system, aimed at cutting cross-infection, uses color-coded bags for disposal of soiled linen, dry refuse, kitchen waste, and soiled dressings. Filled bags are sealed before transporting to a location where they are sorted without physical contact with contents, and sent to the laundry or incinerator. Polyethylene-coated bags are used where most waste is involved, such as in operating rooms and the kitchen.

In addition to hospitals, the sack system is being used in factories, restaurants and municipalities for refuse collection and for collection of litter at public places. Advantages cited include hygienic disposal, ease of handling, flexibility of use.

U.S.I.

Series V, No. 4

POLYETHYLENE PROCESSING TIPS

BLOW MOLDING: SELECTING BEST POLYETHYLENE RESIN, OPTIMUM OPERATING CONDITIONS

The objective of any blow molding job is to make the best product possible most economically. To achieve this objective, resin properties and machine conditions, as well as mold cycle time, have to be considered.

The properties sought in the molded product, of course, depend on its intended application. In each case, the molder must consider the relative importance of these factors: stiffness, appearance, gloss, wall uniformity, weld line, parting line, stress crack resistance.

A product's end use determines whether it must be stiff or flexible. For most products, good appearance – high gloss, smooth surface, no flow lines – and durability are required. Uniform wall thickness, strong weld lines and parting lines with the same gauge as the walls are also desired.

Although gloss is considered a requisite for good appearance, it is listed as a separate property here because there are a number of applications in which low gloss is required. Other products may not need high stress crack resistance which may be sacrificed to some degree to improve other properties.

Mold Cycle Time

The molder must also consider mold cycle time – a most important factor in production costs. Obviously, the shorter the cycle, the more economical the process. But here again, other prerequisites must be considered and a balance struck.

Variables Affecting Properties

Table 1 shows the effect of an increase in resin density and melt index and extrusion and molding factors on the properties of the molded piece. Although the information listed has been obtained by extrusion-blow molding 4 oz. Boston round bottles, it generally holds true for all extrusion-blow molding processes within the ranges shown.

The blow molder can use this table to determine which variables should be adjusted to improve a given property. Also he can learn which properties are favorably or adversely affected when resin density and melt index or extrusion and molding conditions are adjusted. Table 1, therefore, is a useful guide for selecting the most suitable resin and adjusting machine conditions to obtain the desirable balance of end product properties.

Table 1 Effect of Resin, Extrusion, and Molding Factors on Bottle Properties and Output [1]

Increase in these factors affects these properties	Resin Properties		Extrusion Conditions			Molding Conditions		
	Density	Melt index	Melt temperature	Annular die clearance	Extrusion rate	Mold temperature	Mold time	Blow pressure
Bottle properties: Stiffness	Large increase	NSE	NSE	—	Slight decrease	—	—	—
Bottle properties: Stress crack resistance	Decrease	Large decrease	—	—	—	—	—	—
Bottle properties: Gloss	Large increase	Increase at 0.915 density; No effect at 0.932 density	Increase	NSE	—	NSE	Increase	NSE
Bottle properties: Appearance [2]	Improvement	NSE	Slight improvement	NSE	NSE	Improvement	Improvement	Large improvement from 10 to 50 lb/sq in.; NSE from 50 to 80 lb/sq in.
Bottle properties: Wall uniformity	NSE	NSE	Slight decrease	Decrease	NSE	Slight decrease	NSE	
Bottle properties: Weld-line thickness (strength)	Large decrease	NSE	NSE	Large increase	NSE	NSE	NSE	Large increase from 10 to 50 lb/sq in.; No effect from 50 to 80 lb/sq in.
Bottle properties: Parting-line difference	NSE	No effect at low blow pressure; Large increase at high blow pressure	Slight increase	NSE	NSE	Increase	NSE	Large increase
Mold cycle time	Large decrease	NSE	Increase	Increase	—	Large increase	Large increase	NSE
Range of tests limited to	0.915 to 0.932 g/cu cm	1.3 to 4.7 g/10 min	300 to 340 °F	54.5 to 79.5 mil	0.2 to 0.4 in./sec	60 to 160 °F	12 to 24 sec	10 to 80 lb/sq in.

NSE – no significant effect

1) tests on 4-oz Boston round bottles

2) qualitative rating of gloss, surface smoothness, and flow lines in bottle

Table 2
PETROTHENE® Resins for Blow Molding

PETROTHENE	Density	Melt Index	RATINGS: Stiffness	Melt Flow	Stress Crack Resistance	Fast Cycle Time	Overall Appearance	Bottle Application
101*	0.924	2.0	5–	4–	4	4–	5	up to 32 oz.
102-2*	0.924	2.0	5	4	4–	4	5	up to 32 oz.
209-2*	0.920	3.0	4	5	3	5	5	up to 16 oz.
301	0.916	1.0	4	3	5	3	4	all sizes

*Technical data sheets available.

Table shows the relative rating of each resin in each category listed. The highest numerical rating indicates the best resin in each category.

Blow Molding Resins

Table 2 lists four PETROTHENE® resins which are suggested for blow molding. Of these, PETROTHENE 101, 102-2 and 209-2 represent the latest U.S.I. developments in the blow molding field.

U.S.I. has prepared a technical data brochure on blow molding, containing detailed information obtained in the course of an elaborate research program. Ask for a copy. Technical data on other areas of interest to blow molders not yet investigated will be released as soon as available. For information in these areas, or for assistance on any aspect of blow molding, contact the U.S.I. Sales Office nearest you.

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Editorial: Meeting competition

American industry proved itself during World War II—proved it could produce all that was required of it. Not until then had its potential been put to a real test. The post-war period saw production and sales boom but, unfortunately, at different rates. Like agriculture, industry is faced with a surplus. It can produce all it can sell, but can it sell all it can produce?

One of the big problems facing American industry today is foreign competition. This is particularly true of the plastics industry, which has undergone its greatest development since World War II. Not having had a head start, this industry must compete on equal footing with countries whose wage scales are 12% (Japan) to 30% (Western Europe) of the U.S. average. Also, lacking our natural resources, these same countries actually predated us in exploring plastics potentials.

Most of us do not want to see added import restrictions. Economic isolationism is as out-of-date as the political isolationism of the Thirties. In fact, the nations offering the severest competition are the very ones with whom we must do business as friends, or as enemies, the choice is ours.

A pretty grim picture? Not entirely. What we really need is not a larger share of the markets, but a larger market. The world is not yet swamped with goods; merely a small segment of it. There are vast areas where virtually no industry exists, but there is an awakening desire for consumer goods.

How can we compete for markets when at an economic disadvantage? Certainly not by cutting quality in the vain hope of meeting their price. On a short term basis, coupled with higher duties, we could meet it here—but at the risk of ultimately destroying the domestic plastics market.

Foreign competition must be met by better products and better production methods. American industry is investing $14-billion this year in basic and applied research. Here lies our answer. We must capitalize fully on this tremendous technological effort.

Better materials, quality control, proper design, materials selection, production equipment and methods are not problems for the materials and machinery suppliers alone. The plastics processor has a responsibility to himself and to the industry to further his knowledge and improve his methods. We are not a static industry. Developments occur almost overnight, and we cannot wait for comprehensive reference works which may be out-of-date by their time of publication. The technical journals, SPI, SPE, ASTM, and ASA are all doing their best to get this information to you in as timely a manner possible. Something new, the government's Plastics Technical Evaluation Center, is described in this month's Guest Editorial. The American Plastics Institute should be launched soon.

Summarizing, competition is best met by anticipating it and taking the proper steps before it takes over. Currently, we are in the best financial position to develop better products and production methods. The programs and facilities exist. Our task is to use them, wisely and well.

The Editors

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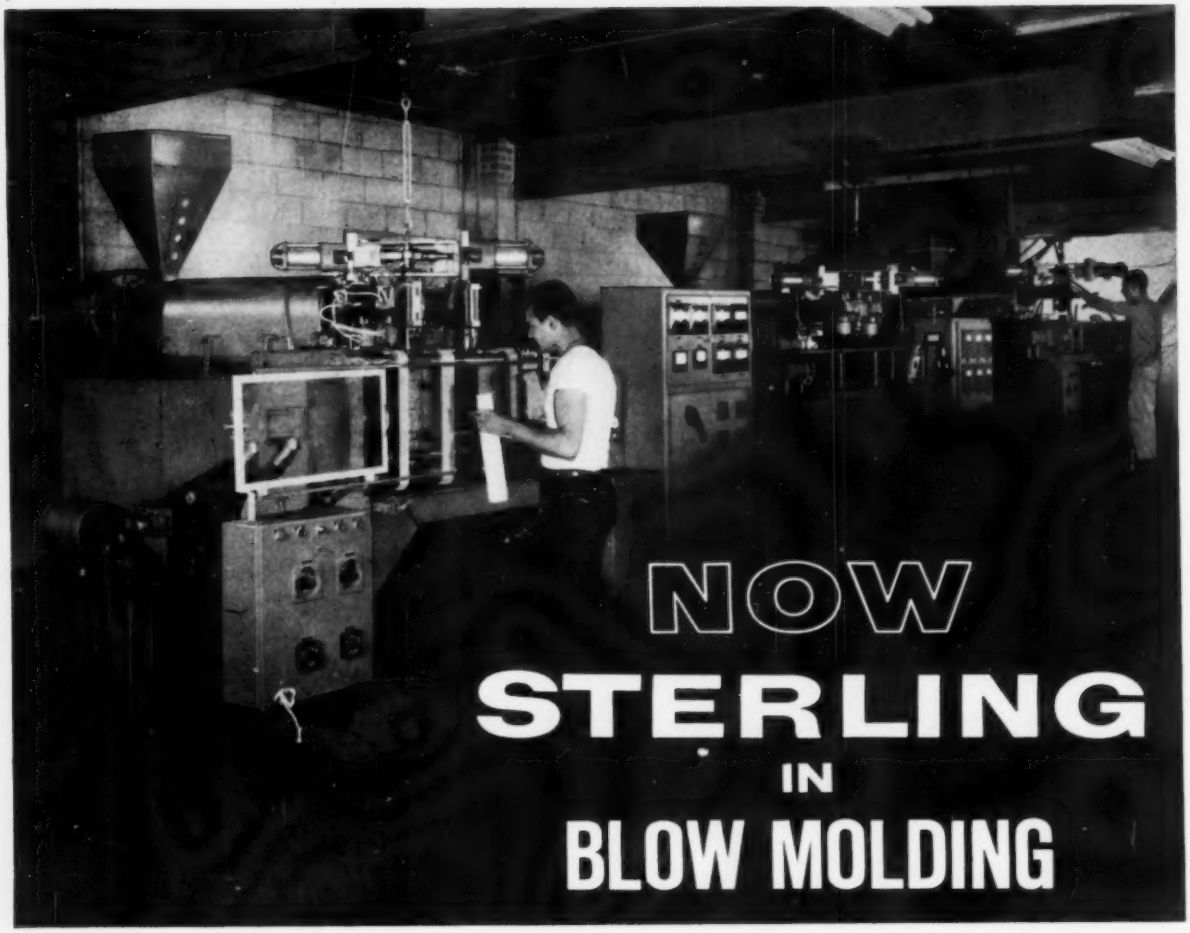

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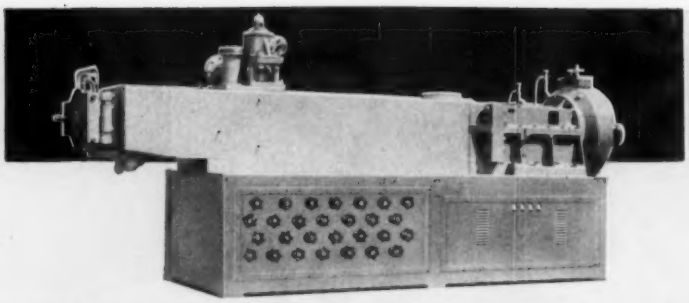

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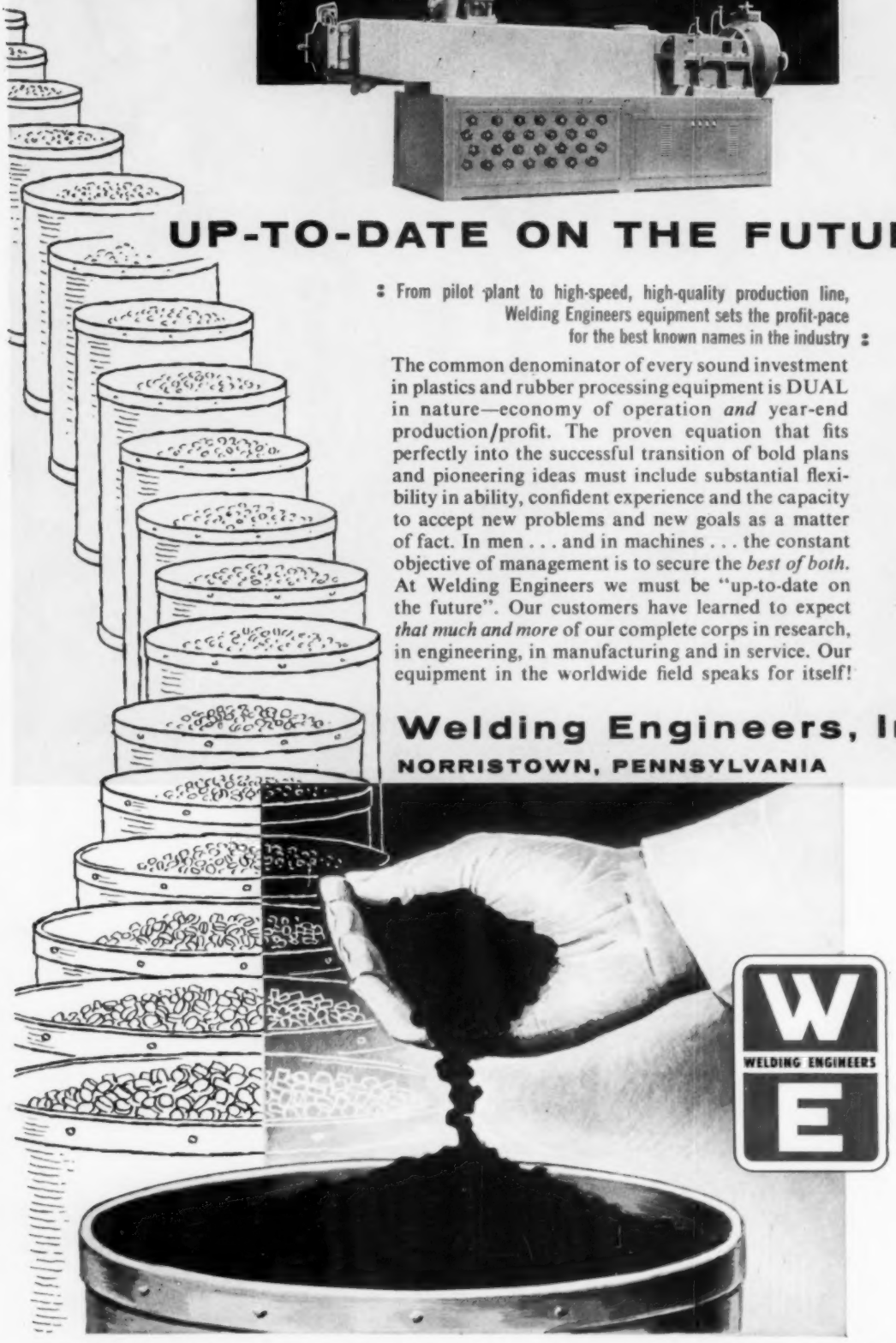

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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

Blow Molding—I. Fundamentals

This start of a six-part article describes the current status and future outlook for blow molding and its applications, with particular emphasis on the injection and extrusion methods and equipment.

ISLYN THOMAS*
N. F. HARWOOD**

Blown items, such as polyethylene squeeze bottles, have been with us for more than 10 years, and have served us well. We have seen blown items used as dispensers, dropper packages, spray packages, and containers for bulk shipments. They have been used with a wide variety of products from cosmetics to household items, pharmaceuticals to basic chemicals, toys, dolls, and industrial items too numerous to mention.

A second development which has been of great interest especially throughout the packaging industry was the commercial acceptance of high-density polyethylene in such areas as nursing bottles, syrup dispensers, shampoo packages, lipstick holders, detergent dispensers, and containers for deodorants and hair-waving compounds. Even now, the estimated demand for blow-molded containers in the detergent market is more than 400-million By 1965, it is estimated that detergents and household chemicals will require two-billion bottles.

The major considerations in selecting high-density polyethylene for the above uses generally encompassed one or more of the following:

(1). Economical-weight container;
(2). Freedom from environmental stress-cracking;
(3). Translucency;
(4). Temperature and chemical resistance.

Resin density is a convenient method of classifying polyethylenes since it is easy to understand and simple to measure. For squeeze bottles, suitable resins lie in the density range from 0.920-0.923 grams/cubic centimeter. Rigid bottles are blown from resins ranging from 0.950 to 0.960. Density also serves as a guide to resin properties since it is related directly to crystallinity, an important factor in many chemical and mechanical properties.

With the greater stiffness of high density polyethylene, it is possible to blow containers of lighter weight which retain enough rigidity to allow easy handling in the filling plant and in the home. Wide-mouth bottles and jars now can be produced at reasonable weights with neck finishes stiff enough to give good sealing characteristics with standard closures.

This stiffness also alters some of the functional properties which we have been accustomed to find in plastic bottles made of low-density polyethylene. A high-density bottle blown at the same weight as a normal polyethylene spray bottle is difficult to squeeze. If we make the bottle lighter in weight in order to improve the spray properties, we may find problems in providing a good fit between the spray plug and the bottle neck. In addition, the recovery time of the bottle after squeezing is now completely different. It is possible to produce good spray packages with high-density polyethylene, but the bottle shape and weight must be selected carefully in order to insure proper functioning.

The question of container clarity is often an important one with users. The higher crystallinity of the high-density resins results in a lower degree of clarity, but product fill-levels are visible through unpigmented high-density bottles. All of the polyethylenes transmit ultraviolet light. For light-sensitive products, or where color is desired for appearance considerations, pigmented bottles can be provided in a wide variety of colors.

While the general characteristics of the high-density polyethylenes are similar to those of the regular polyethylenes, there are some important differences:

(1). Greater rigidity allows the use of thinner-walled bottles with corresponding lighter weights—important from a cost standpoint. Also, with proper design, high-density polyethylene bottles can be produced varying from rigid packages to those having enough flexibility to allow use as dispensers, controlled droppers, or (in some instances) spray packages.

(2). Permeation values are appreciably lower for all liquids tested. Usually, a high-density polyethylene container will cut down liquid permeation by ⅛ to ½ compared to the low-density polyethylene.

* Newark Die Company, Newark, N. J.
** The Granbull Tool Co., Ltd., Kingston-onThames, England

Islyn Thomas is a graduate of Johnson Technical School and the Plastics Industrial Technical Institute, and studied at the University of Scranton and Columbia University. He started in the plastics industry in 1930 with Consolidated Molded Products Corp., leaving as Chief Engineer in 1942. He served as General Manager of Ideal Novelty & Toy Co. for 3½ years, and was an Instructor at Brooklyn Polytechnic Institute. At present, he is President of Newark Die Company, Inc., and Newark Plastics Machinery Corp., both in Newark, N. J. Mr. Thomas is a charter member and past-president of the SPE Newark Section, and was 1951 National President of SPE. With SPI, he is on the Board of Directors and, from 1956-1959, was National Chairman of the Mold Makers' Division. He also is a member of the Plastics Institute, London, England. On the publication side, he is the author of the book, "Injection Molding of Plastics" (Reinhold Publishing Corp.), and numerous technical articles.

Norman F. Harwood was a Design Engineer with R. H. Windsor, Ltd., and studied at Kingston Technical College for a Higher National Certificate in Mechanical Engineering. He joined The Granbull Tool Company, Ltd., in 1946, and has held the positions there of Design Engineer, Chief Designer, and his present title of General Manager. He is the author of many aritcles on bottle-blowing techniques, and is well known throughout the United Kingdom in this field.

(3). Significantly higher resistance to heat permits hot-filling of containers or sterilization of empty or loose-capped bottles. All of these bottles can be steam sterilized by regular autoclave techniques at 15 pounds steam pressure. One word of caution, however—autoclaving should be carried out with the containers unsealed or empty. The strength of the polyethylene is considerably decreased at high temperatures, and any volatile material sealed inside may cause rupture of the bottles.

(4). One disadvantage of the high-density material is the difficulty of removing the excess material (extrudate) from the finished blown item. Specially designed pinch-off areas are recommended. These will be discussed in detail in future sections of this article. To eliminate pinch-off areas around the neck of the bottle, the parison or tube, of course, must be of smaller diameter than the bottle neck. If the diameter of the bottle is within the proper limits to that of the neck diameter, and a material with sufficient blowing ratio is used, the pinch-off area is not necessary at this point.

Future developments

Blow molding is one of the most rapidly-expanding sections of the plastics industry today. It can be defined as a processing technique employing internal air pressure to form hollow plastic objects. Up to 1957, only seven companies blow molded; now, there are more than 180. Over the next 12 months, at least 100 will come in; and by 1965, there should be 1,000.

In the period of the last 10 years or so, the plastic container has developed from the novelty squeeze-bottle stage to a point where it is a serious competitor to the glass container. Until about the middle of 1958, practically all blow-molding equipment was cloaked in secrecy. A very limited amount had been imported from Europe, but the squeeze-bottle industry was based on machinery which the bottle makers had developed and built themselves. The use of polyethylene, in particular, as a packaging material has caught the imagination of both consumers and manufacturers alike. The physical and chemical properties of the polyolefins, coupled with easy moldability, give rise to ever-increasing applications.

Blow-molded collapsible tubes, of the type normally impact-extruded in metal, are one of the more recent applications for polyethylene in the packaging industry (see Figure 1). As industrial and packaging designers become more familiar with the blow-molding process, it will be found that items which have been injection molded in the past can be designed to suit this new system, with its advantages of low tooling costs and high-speed output.

Materials

It is generally true to say that all materials which can be extruded can be blow molded. However, it is not intended to mislead the reader into thinking that all materials are simple to use in production. Blow molding has its attendant problems in the same way that injection molding has, but modern automatic machinery can maintain consistent production once the initial settings and conditions have been established.

By far the simplest and most popular material used currently is polyethylene. This material in all its grades and makes gives consistent results, and may be dry-colored by the molder, making it necessary to stock only natural powder. The phenomenon of environmental stress-cracking can occur, however, when certain products are packed in polyethylene, and it is advisable to seek the expert advice of the material manufacturers to establish the correct formulation for the job. Melt-index range plays an important part in the relationship with stress-cracking resistance on the one hand, and processibility and cycle time on the other. As mentioned

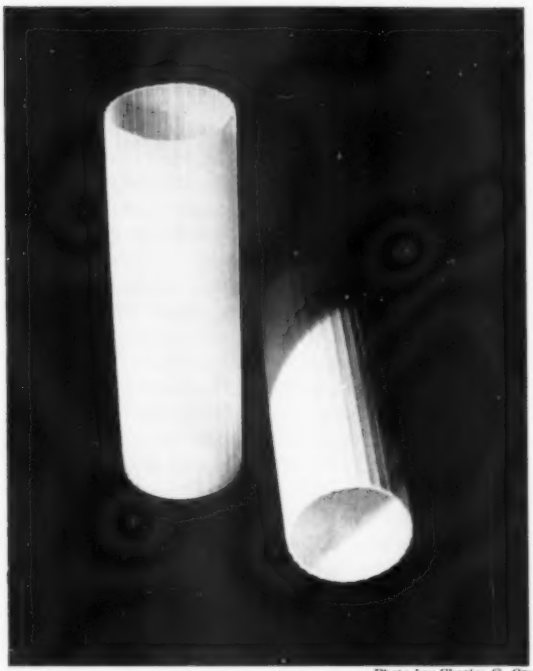


Photo by: Charles C. Orr

Fig. 1. Typical blown collapsible tubes of polyethylene.

previously, rigid polyethylene, although slightly more difficult to plasticize, is ideally suited to the blowing process.

The newer materials, polypropylene and polycarbonate, are both applicable to blow molding; the former being no more difficult to use than polyethylene. In the case of polycarbonate, we have one of the most exciting materials to come from the laboratories to date. Because of its high-temperature resistance, it is somewhat more difficult to plasticize, but the resultant products can be produced with very strong thin walls and are capable of high-temperature sterilization.

Other plastic materials which have been used successfully in the production of industrial parts and containers include nylon, polystyrene, and PVC. A special mention should be made of PVC because a great many tests are being conducted at present in an endeavor to blow-mold items, economically, from clear grades of unplasticized PVC. The problem is solely one of mechanical and/or heat softening without decomposition and, when fully proven, should give rise to a completely non-toxic product of glass-like clarity.

Production Processes

The fundamental principles of blow-molding plastic materials are exactly the same as those applied to the glass-blowing industry. The three stages of the plastic blow-molding process are as follows:

(1). Plastication of the material;

(2). Production of a parison or preform; and

(3). Inflation of the parison within a mold to produce a finished form.

These are the two basic methods of achieving the results, and they may be broadly classified as Injection Blow Molding and Extrusion Blow Molding.

Injection Blow Molding

This method utilizes a standard injection molding machine to plasticate the material and produce a parison. To achieve this, a heated and temperature-controlled hot runner mold is used in the injection machine; handles carrying hollow blow sticks are clamped in the mold; and the plastic melt is molded around the blow sticks within the mold cavity (see Figure 2). The blow sticks surrounded with a blob of semi-molten plastic, are then transferred to a blowing cavity outside of the injection machine (see Figure 3), and air is introduced down the blow stick to expand the parisons to the desired size and form.

It will be appreciated that this method, although basically sound and conducive to good stress-free parison

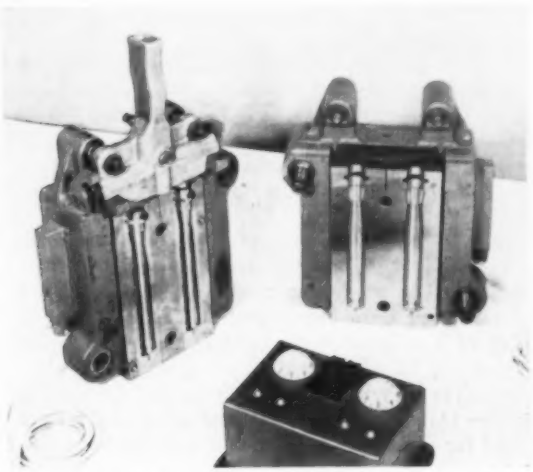


Fig. 2. Two-cavity injection-blow mold, blow sticks in cavities.

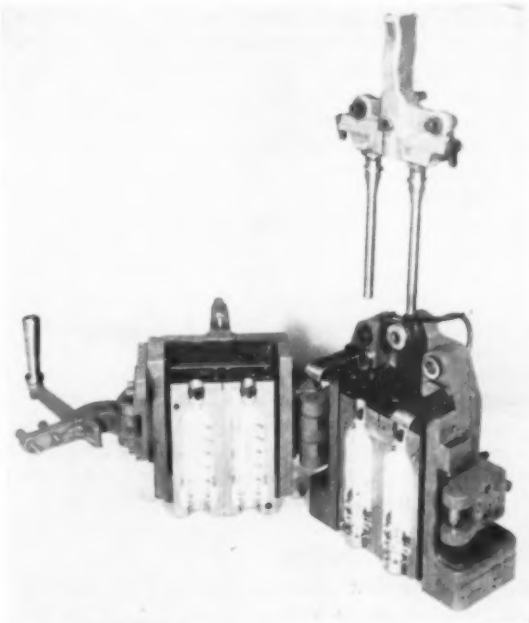


Fig. 3. Blowing cavities outside the injection machine.

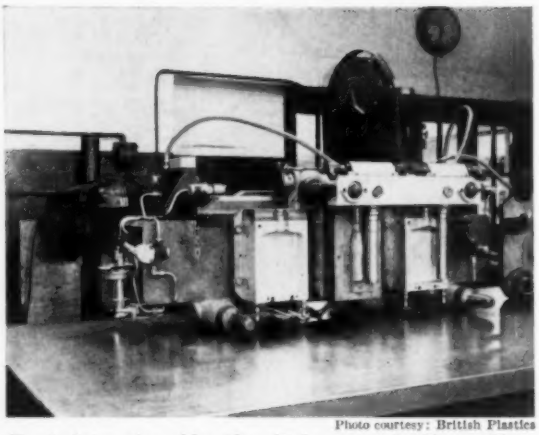


Photo courtesy: British Plastics

Fig. 4. Automatic molds with multiple cavities for blow molding.

production, does not lend itself to high output. In order to improve the production speed and still retain the advantages offered by this process, automatic molds with multi-cavities have been designed. An example of this type of mold is shown in Figure 4. The automatic mold differs from the hand process in one respect—the blow molds are contained within the injection machine platens. The transfer of the multi-parisons to the blowing cavities is done by a traversing head which carries the blow sticks across the machine and is controlled and motivated by a compressed-air circuit. The suitability of a fully-automatic molding machine for this purpose will be appreciated.

There are many arguments both for and against this injection blow molding process, and some of these are offered for consideration. The slow rate of hand-transfer blow-molding can be offset in many cases by the lower capital equipment cost, particularly in the case of small total quantity requirements. The process allows the use of existing injection machinery and, consequently, can provide a wider scope for the injection molder. The greatest objection to the use of multi-cavity automatic equipment of this type is the excessive cost of re-tooling. It is now established that this application is economically sound when used on continuous production by operators who manufacture a standard, unchanging product.

Two points which commend the use of the injection system are a minimum of environmental stress cracking, and the ability to control sections by material disposition. Of these two favorable points, it is the ability to control sections which offers the greatest attraction. Adjustment to the molded parison form can be made readily to achieve very-even sections in the finished product without over-thickening where not required.

Summarizing, it may be said that where small-quantity specialized work is required and where high physical-quality blown items are necessary, the hand injection blowing process may have some advantages.

Extrusion Blow Molding

By far the greatest volume of blow molding is being done currently on machines using an extruder as the plasticating medium. The fundamental principles are unchanged, and the parison now takes the form of a tube before expansion in the blow molding machine. A great many machines of this type are being produced throughout the world, and a wide variation of principles have been adopted which will be described later in this article.

It is significant that the most noticeable design change in recent years is toward machinery which is ancillary to standard extruders, rather than design of the plasticating unit integral with the blowing machine. A further important change which has become apparent is the "reversal of the bottle attitude" while blowing is taking place. On many machines, mostly of early design, the bottles are produced neck uppermost. This usually requires that the blow pin in the extruder head be used internally and, with certain exceptions, controls the neck size of the bottle. The neck orifice cannot be formed to very small diameters easily, since the sizing mandrels are extensions of the extruder mandrel. They must accommodate an air passage and valve, and it is difficult to visualize such an extension with a mere ¼-inch or 1/16-inch outside diameter.

It will be appreciated that this limitation only applies to containers which are produced with open necks. In the case of those made with the neck orifice sealed over and subsequently reamed out, the same problems do not arise. However, the trimming and reaming operations themselves are not desirable from an economic point of view, and this practice now is becoming obsolete.

Bottles blown neck-up have the tendency to a slight thinning at the shoulder section due to "gravity pull-down" of the parison. The resultant thin shoulder could bring about a very bad condition for use with capping machinery that grips the bottle or container in the shoulder area.

The alternative method, blowing with bottle-neck down, overcomes many of the problems outlined in the previous paragraph in the following ways, see Bailey.* The extruded tube is produced in a size most suitable to the bottle section and passes over a blow pin. The tube and blow pin are clamped with the result that the neck and thread are forged to shape. The resultant molding is finished clean at the neck, and the extrudate, which is attached to the bottle, can be pulled off by hand thus leaving the bottle cleanly finished. In the event of thinning at the base of the bottle brought about by "gravity pull-down," the only detrimental effect is one of "feel".

Extrusion Blowing Machinery

The development of this class of machinery has given rise to diverse designs to achieve the same end, and a brief description of the six types follows.

VERTICAL MOVEMENT MACHINES (RISING MOLD). A number of European manufacturers adopt the practice of raising and lowering the blowing dies on a platform to allow the use of a continuously-running extruder. These machines operate in the following sequence: the blow molds close around the extruded tube or parison and descend; at the same moment, a quick-acting knife

* See bibliography at end of article.

severs the tube from the extrusion head; the blow molds remain at the lower position, allowing room for the next parison tube to be produced and, after a suitable period, open and eject the finished bottle. When the ejection is complete the molds rise up once again to start a new cycle (see Figure 5).

This type of equipment can be used to accept single or double cavities between the clamping platens and, in the latter case, are used in conjunction with a double-tube vertical head on the extruder (see Burch patent).*

HORIZONTAL MOVEMENT MACHINES. Machines in this category consist of two molds on a common carriage, and generally function as follows. One pair of mold halves and clamping platens close around the parison tube and move away. At the same time, a second pair of molds are brought into position and await the next parison tube (see Figure 6). After the correct cooling period, the article is ejected and the carriage traverses back to the extrusion position.

ALTERNATE FLOW MACHINES (MANIFOLD EXTRUSION). Machines of this type are very similar to the category just previously described, but substitute a vertical extrusion head over each pair of molds fed from a pressure-balanced manifold. A change-over valve supplies material alternately to one head and then to the other, and no traversing movement is required by the molds (see Figure 7). The extruder runs continuously, but automatically-operated devices allow the material to leave the extrusion dies in staggered sequence. This permits the blowing cycle to operate in matching sequence, and minimum cycles can be obtained in automatic operation.

MULTI-STATION ROTARY MACHINES. This rotary-type machine (see Figure 8) carries a series of molds at evenly-spaced intervals. The mold stations have individual clamping mechanisms capable of sequence operation. All liquids and gases for clamping, cooling, blowing, etc., are conveyed to each station by suitable piping arrangements connected to rotary valves or couplings located within the hub or axle.

The complete rotating mechanism is mounted in fixed position adjacent to an extruder in such manner that rotation is effected in either the vertical or horizontal plane by continuous movement or by intermittent indexing. Extrusion is continuous or intermittent, depending on the method for introducing the blowing air. The tubular material forming the parisons can be severed from the main body at the extrusion die before blowing, or at the mold at a later station.

PINCER ACTION MACHINE (PATENTS PENDING). The most recently developed machine is a complete departure from all those previously described. The pincer-type machine has adopted the established principles utilized in glass-bottle machinery. This action gives high clamping capacity from low-pressure pneumatic supply, and provides excellent clearance for item ejection. Another unusual and useful feature of this machine is that it is supplied as a one-, two-, three-, or four-unit machine; each unit capable of fully-automatic operation on its own, or when coupled with a second unit to form a two-unit machine, sequence operation is carried out.

When a very large volume of similarly-sized containers are required, an appropriate extruder may be equipped with a straight or Y-type manifold that feeds into two double heads to a four-unit pincer type machine. In fact, with eight molds fed from double die-heads, approximately 3,000 blown items per hour may be expected from this type of set-up. Feeder conveyors carry the products to a main conveyor which passes the parts to the finishing, printing, and inspection stations (see Figure 9, a two-unit machine). The operation of the pincer-type machine is as follows: one jaw carrying the blow molds closes around the parison tube and immediately retracts, severing the extrusion from the die head. The extrusion continues and the second head ejects its molded item and advances to take away the next parison tube.

An advantage of the two or more unit pincer-type machine is the fact that, within certain limitations, various types or styles of blown items can be made at the same time. When changing molds, only one production unit must be shut down, while the other units continue in production. The same principles apply when repairing or performing maintenance work; a complete shut-down of the machine is not necessary.

Experience has shown that the greatest single factor affecting output from a blowing machine without doubt is the period required to cool the blown products. It is common knowledge that plastic materials are notoriously bad thermal conductors and, conversely, are equally reluctant to give up heat. Output claims made by machine manufacturers, therefore, should not be considered in terms of "dry-cycle" as is so often the case, but rather on actual blown production with a

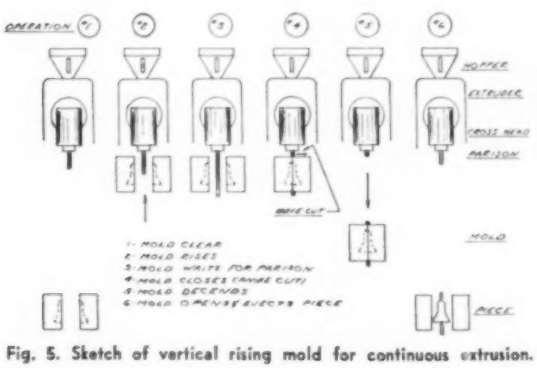


Fig. 5. Sketch of vertical rising mold for continuous extrusion.

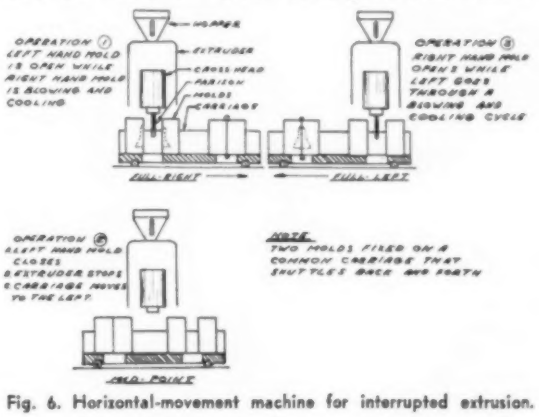


Fig. 6. Horizontal-movement machine for interrupted extrusion.

* See bibliography at end of article.

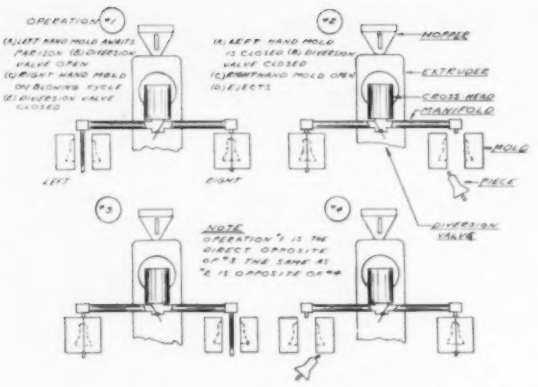


Fig. 7. Sketch of alternate-flow machine with manifold extrusion.

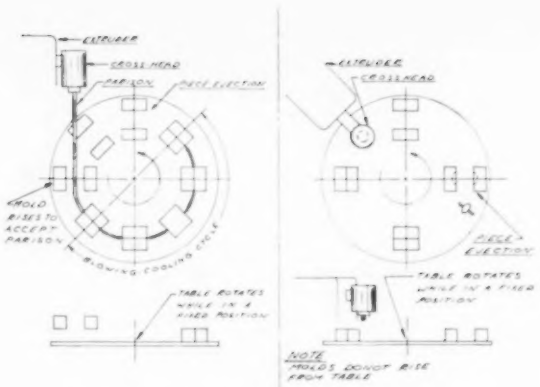


Fig. 8. Sketch of multi-station, rotary-type machine.

commercially-economic container.

The pincer-action machine is designed particularly to provide maximum cooling time. Since the mold jaws are not traversing on a common carriage, the heads do not need to eject their items and approach the extruder head until the last possible moment. For example, if a bottle is ejected too quickly, the heat retained in the thick neck of the bottle will soften the shoulders and the neck will droop. If the blown items are allowed to fall on top of one another, they must cool long enough so that the "tail" also will be cooled and not distort or stick to the bottle it falls upon. The conveyors shown in Figures 9 and 10 will prevent the blown items from falling on themselves.

LARGE CONTAINER PRODUCTION. Most of the machines briefly described above are suitable for blow-molding articles ranging up to 40 ounces in approximate capacity and, in some cases, lightweight containers of up to one-gallon capacity. When the size of the product and, more particularly, the weight of the parison is increased, the problem of extruding a vertical tube becomes more difficult. As the heavy-section extrusion increases in length out of the die, the consequent increase in weight causes the tube to "draw-down"; i. e., stretch and thin out. This generally results in uneven section throughout the length of the finished container and, therefore, is not acceptable. Added to this difficulty is the time taken by a 2- or 2½-inch extruder to make such a tube, thus causing the material to be exposed to the air for a long period of time and resulting in premature cooling in addition to the "draw-down".

One answer to this problem is to use a very large extruder. However, it will be realized that such equipment is expensive both to buy and to operate. Consequently, designers have solved this problem in a more economical way using small extruders, through the developing of a transfer-type machine. In principle, this type of equipment closely resembles the "preplasticizer" assembly of an injection molding machine. The extruder supplies its plastic material into a chamber from which it is forced rapidly through an annular die head to produce a tube. A number of machines based on this design have been produced, and containers in capacities up to 25 gallons or more have been blown.

The machine consists of hydraulically-operated clamping platens surmounted by an extrusion-type die head that is fed from a horizontally-mounted ejection unit (see Figure 10) and a suitable extruder for supplying material to this injection cylinder. In operation, the

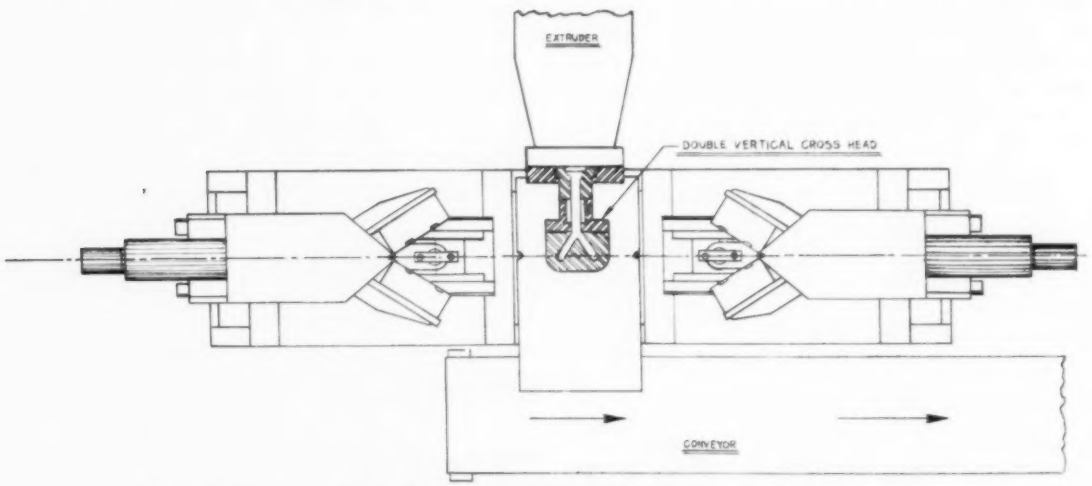


Fig. 9. Cross-sectional sketch of Newark-Granbull two-unit blow molding machine with conveyor.

extruder feeds into the cylinder driving back the injection plunger. At a predetermined setting, the plunger moves forward and forces the plastic into the die head and out through the annular orifice to produce the parison tube. The tube passes over a blow pin, the molds close around it, and the blowing operation takes place as soon as the molds close. The extruder continues to supply a new charge of material into the injection cylinder while the bottle or container is cooling.

The adoption of a horizontally-acting plunger on many machines in preference to a vertical plunger has been influenced by die-head design, which is a vital feature of any blow-molding machine.

Die Head Design

The design of die heads for producing parison tubing is substantially the same as that used for conventional tube extrusion. The right-angle crosshead, such as is used in cable covering, is the basic design used, but modifications have been made to suit different materials. A basic mandrel-type head, as shown in Figure 11, normally is used for the polyethylenes and gives excellent results when kept clean internally. The material flowing into the head divides to pass around the central mandrel which forms the inside diameter of the tube. In practice, this division of flow gives a stagnant area on the opposite side of the mandrel where the material rejoins, and it is this feature that makes such a head unsuitable for certain materials.

To overcome this problem, a more expensive-type of head is used where the internal member is amply supported at the top to withstand the pressure of material coming from the extruder. In addition, the even downward sweep of the radius at the rear of the internal member eliminates the possibility of a stagnant area. The economics of this type head means one standard head for practically all flowable materials.

The use of rigid polyethylene in a diehead containing a torpedo shows evidence of the supporting vanes in the extrudate. Considering this fact, it will be appreciated that the design of a transfer-type machine which will be used primarily with rigid polyethylene must incorporate a mandrel-type head and, consequently, a horizontal feed cylinder.

Mold Making

It is unnecessary for blowing molds to be made in the same high tensile materials as injection molds, due to the much lower operating pressures of the machinery used. The quality of the mold finish, however, is important because blown polyethylene will reproduce faithfully any surface imperfections. Blow molds have been made successfully from aluminum, kirksite, beryllium copper, and sprayed metal, but there is no substitute for steel when long production runs are required. A steel mold for a siphon pump is shown in Figure 12.

The design and construction of blow molds should be given considerable thought because of the newness of this industry. Since the blowing processes are covered by patents controlled by the individual blow molders, legal restrictions should receive careful consideration. It is quite possible that certain blow-molding machines do not infringe on patents that now are issued, but the molds themselves would be in violation. The very complicated patent situation will be described at a later date.

Fig. 10. Large blow molding machine with hydraulically-operated clamping platens and extrusion-type die head fed from horizontally-mounted ejection unit.

Water-cooling lines or channels in the blowing molds are of the utmost importance, and any extra time spent in drilling the maximum possible number of holes will be more than amply rewarded by increased output. The specifications for mold channeling are difficult to define because of the almost infinite variety of sizes, shapes, and wall thicknesses possible. There should be enough

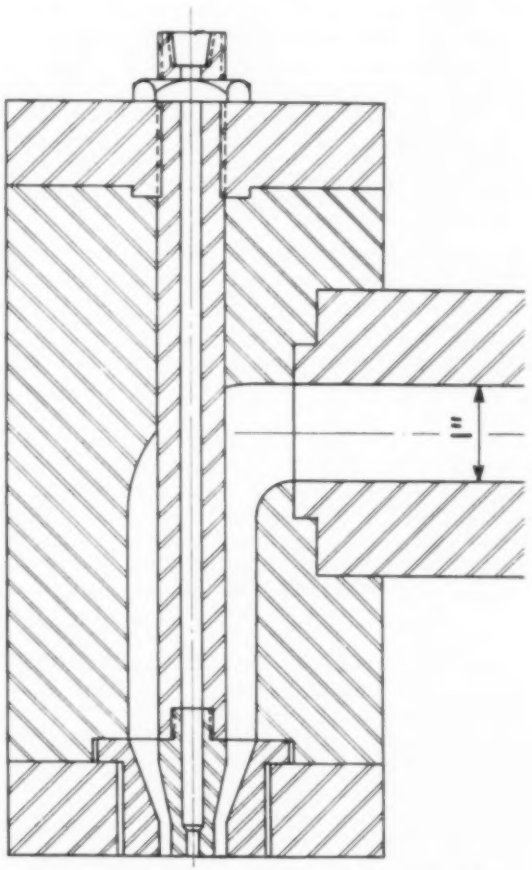


Fig. 11. Cross-section of a basic die head for polyethylene.

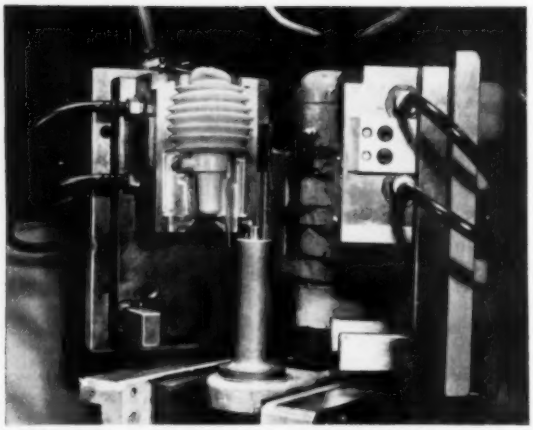


Fig. 12. Steel mold for a siphon pump made by blow molding.

channeling to prevent any significant heat build-up in the mold. Special attention should be given to the neck and pinch-off areas (i.e., the top and bottom of the molds) since the blown items generally are thicker in these areas and more heat must be removed.

The design of the mold cavity will be determined by the part desired. Sharp angles should be avoided, and all corners, ribs, etc., should be rounded to ample radii to help minimize thinning or molded-in stresses. Great care should be taken to ensure perfect mold closure and perfect alignment of the mold cavities. Poor closure or any misalignment, especially in molding high-density polyolefins, will result in thinning along the mold parting lines. Dramatic developments are taking place in blow-mold design, including air sprues, multiple-cavity layouts, and intricate side-action movements. It is hoped that further detailed information may be forthcoming in the near future.

Conclusions

An attempt has been made in this article to outline both the fundamentals and the progress pertaining to this very young branch of the plastics industry. The potential market for blow-molded items is so great that it staggers the imagination. As yet, we have not even scratched the surface of the possible requirements of the automotive and appliance industries. It is very obvious that the techniques for blow molding and its applications will become as well known in the future as injection molding, and that the applicable machinery will develop in the same way.

Two-color blow molding already is an accomplished fact. It has become possible now to blow articles made of polyethylene of two (or more) different colors or of high- and low-density in one single operation automatically. This new revolutionary process, developed by Mr. Reinold Hagen, of Germany, has tremendous possibilities. No doubt before the end of this year, many two-color blow-molded items will be in full production. More about this two- or more-color process will be published in the near future.

One safely can say that output speeds will rise and the size of products will grow, but the plastics industry generally will be in the hands of the chemical engineers and the industrial and packaging designers. No one can foresee the next step upwards until he knows what materials the "steps" will be made from. Blow molding has grown up almost overnight to challenge injection molding as the leader in forging new markets for plastics, at the expense of wood, metal, and glass.

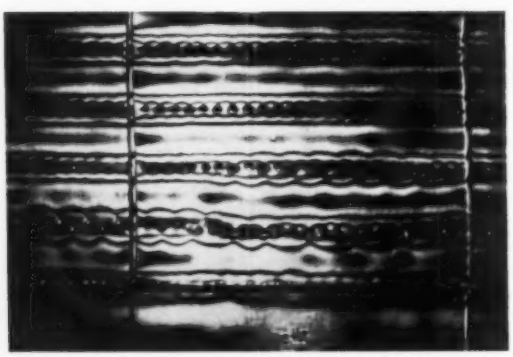
Bibliography

[1]. U. S. Patent No. 2,810,934 awarded to James Bailey, Oct. 29, 1957.

[2]. U. S. Patent No. 2,898,633 awarded to O. G. Burch, Aug. 11, 1959.

—THE END

Converts strain into color



PhotoStress applied to a spot-welded, steel aircraft structure. Dark lines indicate stress distribution around the welds.

Direct stress analyzing of actual structural parts is possible now using PhotoStress, a birefringent plastic which converts strain into color. Available as flat or contoured sheets, and in liquid form, it can be applied to aluminum, steel, or other materials. Convair engineers are using it to test aircraft joint efficiency, where it determines the distribution of loads between lines of rivets or welds.

When the part to which PhotoStress is bonded is subjected to strain, the plastic follows the part deformation causing it to become birefringent—that is, show two sets of fringes under polarized light. Black fringes give the direction of principal strains while color fringes give the magnitude of strain within the part. A product of Tatnall Measuring Systems Co., a subsidiary of Budd Co., PhotoStress actually behaves like an infinite number of tiny strain gages distributed uniformly over the part. Plastic used in PhotoStress is a mixture of epoxy and polyester resins, cured with amine hardeners.—THE END

A. L. Walters

Walter Mundy

A feed-screw design for extruding rigid polyethylene

A preliminary investigation of suitable screw designs.

WALTER MUNDY* and A. L. WALTERS**

Since the advent of extrusion, feed screws with a variety of contours have been developed. There are the fluted torpedo, the smooth torpedo, the "vinyl," the stepless polyethylene, and the one sometimes referred to as the "bump-type" nylon screw. Each was developed with a specific polymer in mind, and each fulfilled its intended purpose quite well. As an example, the fluted torpedo type, often called the Dulmage screw, was designed originally to compensate for short extruder barrels. Through the development of frictional heat, it brought the polymer to the proper state of plastication in a short period of time. It also dispersed pigments well.

With the birth of linear polyethylenes came a new set of problems to be solved. One of these materials, Marlex*** 6002 resin, the type normally recommended for thermoforming, has a melt index of about 0.20, and is a tough polyolefin at processing temperatures. In early extrusion work, output rates were low and the stock temperature, developed through frictional heat, often was as high as 550-600° F. The problem then became one of increasing the production rate and controlling the melt temperature. This was of paramount importance on 4½-inch machines because this is the size found most commonly in industry. These results were obtained on a wide variety of extrusion equipment. Melt temperature is seldom a problem in smaller extruders because the shear rate is normally lower.

Early in the history of these problems, it seemed apparent that the answer lay in the screw design. A so-called vinyl screw, for example, with a 2:1 or 3:1 channel depth ratio gave what we thought would be a good output rate, but there was not enough frictional heat developed to melt the polymer. Fluted torpedo, stepless, and step-type screws with shallow channel depths in the metering section developed excessive stock temperatures. Output rates were low; about 225 pounds per hour. From this it appeared that channel depth along the root diameter must have an important bearing on the problem. Thus, many of the screws mentioned above could be made to perform satisfactorily when proper attention is given to the design of the metering section.

Test Program

In an attempt to find a solution, a series of experiments were arranged through the joint efforts of the National Rubber Machinery Co., Woodall Industries Franklin, Ohio Division, and Phillips Chemical Co.

The extruder used was a standard 4½-inch NRM equipped with Varidrive and a 50-horsepower motor. Its speed range was 0-60 rpm. The screw was a full-flighted metering type (see Figure 1) with a 20:1 L/D

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*** Marlex is a trademark for Phillips' family of olefin polymers.

Table 1. Data Obtained From a 4½ Inch Extruder.

Channel Depth, In., in Metering Section	Screw Speed, rpm.	Head Pressure, Psig.	Stock Temp., ° F.	Output, Lbs./Hr.
0.109	24	1,250	455	60
"	47	1,500	515	225
"	60	1,550	535	285
"	60	1,300	495	180*
0.125	24	—	435	160
"	47	—	465	247
"	60	1,100	475	330
0.150	47	2,200	435	337
"	60	2,200	440	405

* Almost the full length of the screw was cooled with 150° F. water.

and a 3.94:1 channel depth ratio.

To establish a base or datum line, a run was made at three screw speeds (24, 27, and 60 rpm.) using Marlex 6002 resin (ASTM Type III). The screw then was removed and sent to National Rubber Machinery for the purpose of increasing the channel depth in the metering section from 0.109 to 0.125-inch. It was reinstalled and the run repeated, using the same screw speeds, the same temperature settings, and virgin polymer from the same lot. The complete set of conditions for all runs were: 350° F. (hopper), 370° F., 390° F., 400° F.; and 400° F., for the barrel; 400° F. for all die zones; neutral screw; water cooling on hopper; 150° F. hopper dryer; 20-80 screen pack; and barrel blowers turned off. A 50-inch sheeting die with lips set at 125 mils when hot was used. The stock temperature was measured by a thermocouple inserted into the polymer stream in the die immediately down-stream from the strainer plate.

After completing the second run, the channel depth along the full length of the screw was increased to give a channel depth ratio of 3.54:1. The channel depth in the feed and compression zones was increased by $\frac{3}{32}$-inch, while that in the metering section was made 0.025-inch deeper.

Test Results

The results obtained are listed in Table 1. From this Table, it will be noted that the output rate at 60 rpm. increased from 285 to 405 pounds per hour. Also, from a comparison between the first and third runs, the stock temperature dropped from 535° to 440° F. Subsequent runs made after the completion of the experiment showed output rates on the order of 500 pounds per hour. This was accomplished at a screw speed of 75 rpm. The quality of the sheet produced during these experiments was good, and there was no evidence of surging.

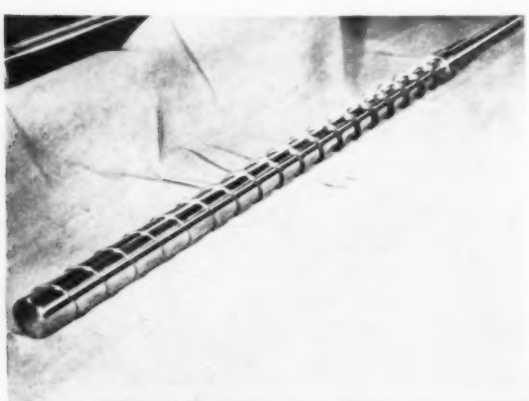

Fig. 1. Full-flighted, metering-type screw used in test program.

This, like most experiments, is incomplete in some respects. It might be asked if the final channel depth arrived at is optimum. At this time, we do not know the final answer. However, it was learned from a subsequent experiment on another make of 4½-inch standard extruder that a 0.200 channel depth (3:1 depth ratio) was too great. Some surging was noted in this instance but there was no temperature rise. To produce a good extrudate it was necessary to use some water in the screw. This, in effect, decreased the channel depth. This screw and the one used in the main study were similar in form.

As channel depth increases, the ability to mix as well as to melt the polymer (by friction) decreases. From the standpoint of mixing, the final screw contour is not as good as the one used originally. While this is as expected, the deeper-channel screw should be very satisfactory for most uses. The use of a fine screen pack would help to improve mixing.

Conclusions

It has been our experience that information of the sort included herein is of real interest to the extrusion industry. It gives them a ready answer for 20:1 L/D machines, and permits the engineer to make an "educated guess" for extruders with higher ratios. We feel that cooperative work of this nature is beneficial to all concerned.

While an extension of this investigation is not planned, it is the hope of the authors that others in the plastics industry may see fit to extend work of this type.

—The End

Errata

While our gremlins jump with joy, we wish to apologize for errors that crept into our May and June issues despite almost inhuman carefulness.

In Part I of the article on "Effects of Secondary Plasticizers on Processing of Vinyls," that appeared in May, the approximate molecular weight of the Aromatic Hydrocarbon, Code Letter B, in Table 1 (pp. 47), should have read 412 instead of 5-8. In Part II that was published in June, the dielectric control for Code I in Table 7 (pp. 39) should have been 3.803 instead of 3.923.

In the article, "Production Processes for Gel-Coated Glass-Polyester Plumbing Fixtures", in the May issue, the following paragraph on "Production" was omitted between pp. 50-51:

"With the exception of the mold gel coat, all other formulations must be given some type of milling. Mold gel coat will be improved greatly by milling, but satisfactory results may be expected with intensive propeller . . ."

Advances in phenolic materials and processes during 1959

A. P. LANDALL**

At first glance, it might seem rather peculiar to write an article on advances in phenolics, particularly since this class of plastics has been around for so many years and its applications are so well established. Consider, though, the remarkable growth of phenolics during the year 1959. Production of molding compounds alone increased more than 30% over 1958, and reached an all-time high in the history of phenolic materials. It might well be argued that the over-all economy expanded tremendously during 1959 and phenolics merely went along for the ride.

I think that an examination of the facts, however, will point up that there had to be some impetus other than just an upward movement of the general economy to account for this tremendous increase in phenolic molding compound manufacture. It is an established fact that phenolics are extremely well known and that, by and large, their applications have been laid out and also are well known. Of course, there are new applications for phenolics opening up continuously—one of the more glamorous being usages in the missile and rocketry fields. While the volume is not overly large, it has been publicized widely and may grow to a large-volume application sometime in the future.

It would be hard to find a new application to rival that of the molded television cabinet boom of a few years ago. Even though this tremendous market has since dried up as far as phenolics are concerned, phenolics have continued to grow in ever-increasing volume year by year.

How then can we assess properly the large advance in phenolic production during the past year? There appears to have been no marked improvements in fabricating equipment, but there have been some improvements in the use of auxiliary equipment. For example, work has been done in improving cure cycles through a better understanding and better utilization of electronic preheat. Trembley (1)* has reported that with very high frequency and high RF voltage preheaters, materials can be preheated to 270-325° F. in 30 seconds, thereby markedly reducing cure times. The utilization of this knowledge and similar research done by Guzzetti and Wechsler (2) has enabled the molder to quote lower prices and keep many jobs in phenolics which otherwise would have gone to other materials. Work reported by Vail (3) with respect to preform density and its bearing on lowered scrap rates also has enabled the molder to take advantage of possible lower cost.

This, however, is not the whole story. The stabilized phenolic industry with its wealth of background knowledge has found itself in the unique position of being able to tailor-make materials readily to suit specific applications. The phenolic compounder and formulator have learned the delicate balance between formulation and end properties. The phenolic industry, therefore, has become to a large degree an industry of special-purpose materials. Even the old G. P. nomenclature should fall into discard. The molder and end-user have learned to come to the molding material supplier when they need modification of their so-called G. P. materials. Each supplier has literally hundreds of G. P. formulations in his files, specifically designed to meet a particular end-use or molder requirement.

The best of these are offered for general commercial sale, but background information constantly is on tap for use whenever the need arises. New applications which may consume relatively small volumes initially, are constantly being brought to the attention of suppliers. Through their formulation know-how, they are able to design materials with the exact balance of properties required by the end-user and at minimum cost to the molder. Constant research broadens the base of knowledge which can be given to both the molder and end user.

(Continued on page 43)

* Numbers in parentheses refer to Bibliography at end of article.

** Mgr. Technical Service Engineering, Chemicals Materials Dept., General Electric Co., Pittsfield, Mass.

Guest editorial

The plastics technical evaluation center— a new project and a new concept

H. E. PEBLY, JR.*

The Department of Defense has established a technical evaluation center to deal with plastics and reinforced plastics. These materials have proved of extraordinary technical value in advanced missile designs and are moving into progressively wider military use. They are of very strategic importance to the Department.

The limitations on plastics are largely technical. Although widely used in commercial applications, they have tended to resist standardization as to quality and performance. For military service, these limitations are grave. The military departments require materials and designs of highest reliability and this requirement implies exact knowledge of performance capabilities and uniform quality of product. Unless these are achieved, plastics will remain less than fully exploited for military use.

Most plastics firms are small and the plastics industry is widely diffused and competitive. Sponsorship and cost-sharing of an adequate program to handle and refine engineering information must, as a practical matter, be borne outside the industry. Because of the military potential of plastics, we consider this to be an appropriate place for government action. Accordingly, Picatinny Arsenal, an installation of the Ordnance Corps, Department of the Army, is establishing the Plastics Technical Evaluation Center at the Arsenal in Dover, N. J.

The functions of the new Center are:

(1). To collect, evaluate, store, and disseminate technical information on current development, engineering, and application work in the field of plastics and reinforced plastics.

(2). To provide technical assistance and consulting services on problems involving the use of plastic materials to military contractors and suppliers.

(3). To prepare and issue state-of-the art reports on important and advanced technological aspects of plastics engineering.

(4). To stimulate advances in standardization of processes, products, testing methods, and materials in the field of plastics.

We believe that the action in this field of plastics, which follows somewhat along the lines already taken earlier in the establishment of a Defense Metals Information Center at Battelle Memorial Institute with very gratifying success, deserves the serious consideration of scientists, technical people, and administrators in private industry. For this reason, I should like to review the reasoning process that led to the decision to establish the Plastics Technical Evaluation Center. Stated in simplest terms, the technical evaluation center is a device to help the design engineer meet his technical information needs.

I am indebted for the following observations to Mr. John Townsend, Special Assistant to the Director of Defense Research and Engineering, and Mr. Frank Huddle and Mr. Paul Forsyth, Office of Fuels, Materials and Ordnance, Office of Director of Defense Research and Engineering.

The product of research is information. Much labor and time, using rare skills, are needed to produce this information. To the scientist, the garnering of information is an end in itself. He downgrades his own usefulness if he tries to anticipate the usefulness of his findings. We do not want him to do so. This means that we have a heightened responsibility to ensure that the findings of our scientists are constantly being looked over, winnowed, and screened with care to identify currently useful items. We owe our scientists that.

In the past, this function has been performed by a sort of osmosis. Ideas gradually filtered out of the basic research laboratory and into the applied research laboratory, into the industrial laboratory, and finally reached the engineer. Charles F. Kettering once was asked

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to tell an audience the difference between fundamental and applied research, and answered; "About 20 years."

The pace of discovery and the pace of application have been stepped up. If we wait for the process of information flow to proceed unguided, we will be swamped with unused data. Our advanced designs will suffer dangerous lags. There needs to be a balance among the various levels of research and engineering effort. To maintain this balance, we must bridge the gap between them by improving communications. Communication, in this sense, is not merely a matter of convenience. It is a way to conserve the precious time of the scientists; a way to quicken the pace with which new creative ideas pass from the point of origin to development, test, and application.

The traditional passageway for communications is the library. One means of improving communications is by strengthening our libraries and equipping them with one or another of the countless varieties of electronic machines that take the place of human bibliographers in tabulating and searching for relevant information. This we should indeed do. But there has been a change in the character of library staffs over the years. In the great library at Alexandria, in the Third Century B.C., a succession of scientists occupied the post of librarian and contributed enormously to the synthesis of the world's learning. In somewhat the same fashion, we are proposing to do this in a more limited way at Picatinny Arsenal. But in the intervening centuries, human knowledge has become so multiplied and areas of knowledge so specialized, that today the professional librarian has all he can do to keep up with the progress of technology in his own field. I do not believe that the librarian, aided by automatic devices and bibliographical skills, can help us greatly in our problem of engineering communications. One indispensable ingredient is omitted from such systems. That is the technical judgment factor.

For engineers, it is of less importance that all information be exhaustively accumulated on any given subject, than that a sound body of *useful* technological information—engineering data, process descriptions, standards, quality and performance expectations—be compiled and placed without delay in the hands of those who need this information in a form in which they can use it.

The research scientist will willingly read and conduct exhaustive literature searches, but the engineer is less well equipped and differently oriented, with many demands on his time. He has to meet deadlines. If information is not readily at hand on a material or system, he normally will pass it by for later consideration. For the scientist, information needs to be complete; but for the engineer, information needs to be evaluated.

Moreover, because the engineer works against time, those concerned with development of materials for engineering purposes have less responsibility for, and interest in, sharing their results with others in the field. Quite apart from the undoubted existence of proprietary restraints on information flow, the engineer is preoccupied with structures, rather than publications. The scientist is fond of the prestige of being the first to publish a new discovery. Engineers are much less moved by this incentive.

Characteristically, the results of developmental engineering are "codified" in the form of an accumulation of notebooks, records, working papers, internal staff reports, and unrecorded data in the head of the engineer. These data may not find their way into published literature for a year or two, if ever. Its publication is not automatic, and no incentive is provided by the engineering profession itself to have this done. One might suppose that there was adequate economic incentive to move major industrial enterprises to record and disseminate the data they need and the data they wish their customers to employ for mutual benefit. To some extent, this undoubtedly is done, but the gaps are serious. Accumulation, evaluation, and dissemination of this great body of technological data required the purposeful services of an outside agency.

In identifying these deficiencies in the generation and flow of reliable, up-to-date engineering information about plastics, we believe we have contributed a service of significance that extends far beyond the field of plastics. For what is true of the plastics industry and its technology undoubtedly is also true in many other areas of industrial science. Those in the field of plastics are encouraged to make use of the Picatinny project and to test its efficacy first hand. Those in other fields are encouraged to ponder this example, and to consider whether the principle could be employed with equal value in their own fields of interest.

—THE END

Advances in phenolic materials and processes during 1959

(Cont'd. from page 41)

Although there were few if any startlingly new phenolic materials announced during 1959, it is almost axiomatic that it takes about two years from the introduction of a new and radically different phenolic to become accepted by the industry. We are now reaping the harvest of developments which took place during '57 and '58. There is also the constant research and development work that is going on in the industry to speed cure, attain greater versatility, and improve finish and various other properties of molded articles.

These have been the reasons for the spectacular advance in phenolics and the cause for optimism among phenolic manufacturers and users. We confidently expect that during the Sixties the phenolic market for molding compounds alone should grow to more than 250-million pounds per year, whereas only a year or two ago the most optimistic reports that one could find placed a ceiling of about 200-million pounds per year.

Bibliography

(1). "VHF Preheating for Thermosetting Molding," J. F. Trembley, **SPE J.**, 15, 7, 543 (July 1959).
(2). "Faster Cure Through Hotter Electronic Preheat," A. J. Guzzetti and R. L. Wechsler, **SPE J.**, 15, 4, 293 (April 1959).
(3). "Preform Hardness vs. R. F. Preheat Time and Temperature of Phenolic Molding Materials," E. W. Vaill, Paper 32 in Technical Papers, Vol. VI, published by the Society of Plastics Engineers, Inc., Stamford, Conn. (Jan. 1960).

—THE END

Advances in plastics materials, 1959-1960

C. B. THAYER*

Several important commercial developments in plastics materials occurred during the past 18 months. Prices of some newer plastics decreased partly due to improved production facilities and efficiency, and in other cases because of competition.

The Food Additive Amendment of 1958 became effective on March 5, 1960, "to prohibit the use in food of additives which have not been adequately tested to establish their safety." This prohibition also applies to substances which may incidentally become part of the food due to being in contact with it. This amendment applies directly to the plastics which are used for packaging food materials. It affected nearly all producers of plastics as well as a large number of fabricators who manufacture various kinds of plastic containers and wrapping materials.

There was much emphasis on fire safety of plastics in current use. This was especially noted in the household appliance and building products fields. The problem was highlighted by a bulletin of Underwriters' Laboratories with regard to the use of combustible plastic materials in room air-conditioners. Accelerated progress was made in developing fire resistant materials as a result of this bulletin and the interest which it aroused throughout the industry.

Several of the new materials which have been introduced during the past five years are gaining ground in volume of use. Thermoplastic materials which cost more than 40c per pound have to find applications where their unique properties dictate their use.

Foams, polypropylene, polyethylene, and polyvinyl chloride are making excellent progress in volume of use and in wider range of applications. Reinforced plastics continue to gain, and many technical articles have been presented to show the effect of formulation and fabrication upon the properties of finished products. The high costs of hand labor on some types of reinforced-plastic items do not appear to be holding the material back very much.

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The advertising pages carried many notices of old and new catalysts which are available to the plastics industry. A considerable amount of space is being devoted to advertise non-toxic plasticizers and fire-resistant thermoplastic materials.

New Materials

Several different brands of polycarbonate plastics have appeared. The German material is called Makrolon. General Electric Co. is to have a plant ready to produce Lexan near Mt. Vernon, Indiana, late in 1960. Merlon was announced by Mobay Chemical Co. It is to be made in the United States, and the production experience gained in Germany by the Bayer segment of Mobay will be made available to help the United States version grow quickly.

The Dupont acetal resin, Delrin, remains the one material of its kind in the field. It became available in production quantities during the summer of 1959 at a price of 95c per pound. Technical articles concerning this material show it is continuing to grow in range of applications and volume of use.

Penton, which was introduced five years ago by Hercules Powder Co., was reduced from $6.00 per pound to $3.50 in the middle of 1959. It is said to compete with corrosion-resistant metals for piping, pumps, and valves at this new price.

Acrylic polymers saw some new developments. An extrusion grade of methyl methacrylate, called Lucite 147, was introduced by DuPont to supply the growing demand for various extrusions of this material. Two copolymers of methyl methacrylate were introduced by J. T. Baker Co. One of them, PL 11, has 250° F. heat-distortion temperature, and has similar optical properties when compared with methyl methacrylate. PL 12 has 240° F. heat-distortion temperature, has a slight haze, and is not water-white.

Phosphonitrilic chloride polymers have been made in sample quantities with high-temperature resistance characteristics as materials for rockets. Advancing missile designs have established requirements beyond the

properties of all commercially-available materials according to an authority on long-range missiles and space vehicles. The alternative at the present time is to design and fabricate as best we can to use the materials to their maximum advantage. It appears to be a difficult task to develop materials which have all of the qualifications required for rockets and vehicles for space exploration. Occasional references to new materials are found, but no large amount of technical data is presented at this time.

Polyethylene

Polyethylene passed one-billion pounds per year production at the end of 1959. It may be more convenient to describe this much material as 500,000 tons. A great deal of technical information and promotional literature was noted during 1959. Among the outstanding things which were announced were flame-retardant formulations, and formulations to repel dust. A series of bacteriostatic materials was announced, and a number of applications were suggested. None of these materials have found their way into large-volume use as yet.

Ethylene copolymers have been a subject of high interest, and continue to arouse much interest. Several copolymers were announced and described in more or less technical detail. One copolymer was introduced by Union Carbide Corp. without announcing the nature of the monomer combined with ethylene to make this material. The comonomer is said to be an acrylate, according to one speculative source of information. Ethylene-butene copolymer resins have been described as having improved stress crack resistance, and as being especially good for use as detergent bottles. The copolymer was rated better than high-density polyethylene in this regard. It also was recommended for wire- and cable-coating because of its resistance to thermal stress-cracking. This material also was found to be good for making sparkling clear films.

An ethylene-maleic copolymer is water soluble, and is offered as an intermediate for film formers. It also is offered as polymeric liquids or waxy solids.

Coating resins of polyethylene are finding greater use, and considerable emphasis is prevalent on expanding the uses in this field.

Fillers for polyethylene have been studied at considerable effort, and one filler system is said to be activated to promote cross-linking. Another filler system with calcite reduces shrinkage when the material is molded or extruded. Cross-linked polyethylene containing from 40-75% carbon black produced by Godfrey L. Cabot, Inc., has been successful as an insoluble, noncorrosive material which has low creep at high stress. In the pipe field, the fittings have been a problem because it is not feasible to use cemented fittings due to the lack of a suitable cement which can serve universally for many applications.

One manufacturer plans to produce carbon black dispersed in polyethylene. This is a very difficult manufacturing process because the dispersion has to be very thorough to prevent entrance of light into the polyethylene, and thereby stop deterioration due to the actinic rays. One technical article described the use of polyethylene for the Trans-Atlantic cable. The selection of materials for this cable had to be based on long life and freedom from deterioration, without more than passing regard for cost.

Several studies of stress-crack resistance were found, and there is considerable disagreement as to what is the best and universal method for determining it. A crystalline material, such as polyethylene, is difficult to fabricate into a standard test specimen in the first place, because it is difficult to standardize the condition of the crystals after fabrication. The crystals usually have high resistance to the stress-cracking agent, and the amorphous materials between the crystals are very much less resistant. If orientation has occurred during fabrication, the resistance to stress cracking is further complicated because it is very difficult to know how much change in strength occurs in the boundaries between the oriented molecules.

There were price reductions in December 1959, on high-density, medium-density, and low-density polyethylenes because the situation has been confused. Some authorities indicated that standardization alone would not eliminate the confusion. There was a five cent reduction in high-density polyethylene early in 1959 which was attributed to the fact that the 1958 capacity was 300-million pounds per year and the estimated sales during that period were 65-million pounds. The extra stiffness of high-density polyethylene seems to be the principal competitive advantage over low-density polyethylene in the large housewares field. The adaptation of high-density polyethylene may be slow if it is to depend upon its greater stiffness alone. The use of 0.25 melt-index material for pipe and other industrial items seems to be confined mainly to Europe. American fabricators have not found it very easy to mold or extrude such materials, and large-volume applications have been hesitant—possibly for this reason.

In order to provide a background of interest and understanding in the minds of New York's housewives, a molding machine was installed at Macy's to run both low-density and high-density polyethylenes, and thereby show the customers what the molding process is and what differences there are between the two kinds of polyethylene. Polyethylene tubing was used successfully for ice rinks. The complete tubing for a hockey rink was set up without joints. A rink is 185-feet long, and the pipes were fed by a header pipe at one end and connected by return bends at the other end. The contraction of the pipe at 20° F. was found to be seven inches in the 185-foot length.

Polypropylene

Polypropylene is beginning to become more and more available, and has found a good application in automobile seat covers and outdoor furniture in the form of monofilaments woven into webbing. A great

deal of conjecture was evident concerning polypropylene film, and few samples were shown and discussed. Some films are in production and used as overwraps for paper products.

Polypropylene pipe made of Moplen brand polymer was described in one technical article. The pipe had one-inch inside diameter and its burst pressure at 100° C. was 30% of that which was displayed at 22° C. This burst strength is three to four times that of low-density polyethylene which has an upper yield limit of 50° F. The polypropylene was described as having a molecular weight of 22,000, and having high impact strength at room temperature and resistance to stress-cracking by polar liquids. It was not as good in burst strength as polyvinyl chloride up to 70° C., which is the upper limit for standard polyvinyl chloride. The polypropylene performed better than polyvinyl chloride, however, between 70° and 100° C.

The current estimated capacity for production of polypropylene at the end of 1959 was 50 to 60-million pounds. It is estimated by the end of 1961, the production capacity will be 430-million pounds.

Foams

Urethane foams attained great importance during the past 18 months. Many people became skilled in manufacturing foams from the wide variety of urethane formulations, and in different methods of manufacturing such as spraying, foaming-in-place, or fabricating board-stock. Urethane foams which are blown with fluorinated hydrocarbons have a very low thermal-transmission factor, and this has been attractive to the household refrigeration industry because thinner walls can be designed and provide more space inside of a given exterior-dimension box.

A low-density polyethylene foam at approximately two pounds per cubic foot was introduced as available in the form of rounds, ovals, or planks. Polyvinyl chloride cushion foams showed considerable growth without any great new materials change. The evidence appears to be that the growth has come from increasing awareness of the advantages of the material for furniture cushioning.

High density cellular polyvinyl chloride foam in a range of 40 to 75 pounds per cubic foot became available as extruded stock. This material is suggested for screen splines, glazing, welting, weather stripping, and as a buoyant cable coating to provide for floating cables or electrical conductors. Self-extinguishing polystyrene foam became more readily available with improved self-extinguishing properties. Foamed epoxies in a range of 2 to 25 pounds per cubic foot rigid material were described in one technical article. Another series of articles described foaming polystyrene beads by mixing them with an epoxy resin. The resin cure provides sufficient exothermic heat to cause foaming.

A very practical use of urethane foam was described in a short article. The foam was used to form the base of a bathtub made of polyester reinforced fiberglass material. The urethane, foamed in place on the bottom of the tub, provided a rigid support for the weight of the bather and the water inside the tub.

Styrene Polymers

Production of styrene polymers continued to grow during 1959, in spite of some previous estimates which indicated its growth would be likely to taper off. This material passed the 500,000 ton annual production rate at the end of 1959.

Two styrenes were taken off the market during the 1959 period. Methyl styrene and the copolymer of methyl-styrene acrylonitrile were discontinued by their manufacturer.

A new styrene-methyl methacrylate copolymer was announced by Dow Chemical under the name Zerlon. A technical article described the properties of the water-white material which has high heat-resistance and relatively easy moldability.

The work to produce polystyrene having stability in connection with fluorescent-lamp radiation continued, and several new light-stabilized polystyrene formulations were introduced. Technical articles and advertising pages described the improved properties of these materials, and considerable evaluation of them was conducted during the year.

Polyvinyl Chloride

Thermal stabilizers which have been used successfully in polyvinyl chloride are not all suitable for contact with foods. The effect of the new Food-Additives Amendment has not been checked out thoroughly with regard to polyvinyl chloride, but one extruded PVC formulation was announced by Goodyear Tire & Rubber Co. as being approved for food use. One effect of the Amendment was analyzed by one commentator as limiting development to people of high responsibility and sufficient substance to make extensive tests.

A vinyl plastisol-coated steel sheet was announced by United States Steel Co. This has an embossed finish with 0.008-0.020 inch thick plastic coating. The laminate showed no corrosion underneath the plastisol at the interface between the vinyl and the steel. The sheet is offered at approximately 2½ times the price of steel sheet alone. It is expected this price scale will attract some applications which have required costly finishes to protect the steel from corrosion.

A German development from Farbwerke Hoechst was announced late in 1959: a mechanical blend of polyvinyl chloride and chlorinated polyethylene which should provide easier processing than polyvinyl chloride alone. The blend might be satisfactory with less thermal stabilizer or with a less-efficient stabilizer than has to be used for polyvinyl chloride.

Rigid polyvinyl chloride has made its way well in Europe for many years partly because of favorable labor costs and partly because of shortages in other suitable materials for industrial components requiring chemical resistance. In the United States, molding the material has been a problem because injection molding requires high pressures, and because extrusion of slugs for transfer molding requires considerable thermal stability and possibly some compromise through the addition of plasticizers to allow extrusion. A technical article described transfer molding of rigid polyvinyl

chloride through the use of dielectric heating, and the results of this molding process were described as very successful. Possibly, this type of molding operation will take hold in the United States and cause the wider use of truly rigid polyvinyl chloride.

Early in 1959, a price decrease of 1½¢ per pound on polyvinyl chloride was made, both to stabilize the market and to meet the price of imported resin.

Epoxies

An advanced television-tube design was described in which the glass safety panel in front of the tube is fastened to the tube by a layer of epoxy resin. This produced a brighter picture effect by eliminating the reflection between the two layers of glass and keeping the layers filled with transparent resin so dust could not collect.

Compression and transfer molding compounds of epoxy resins were announced by Fiberite Corp.

Polyesters

Developments in polyester premix technology were conspicuous and plentiful during the year. Technical papers described simplified testing of compound uniformity as a means of potential improvement in the reliability of the molded parts. Another article discussed the physical properties of polyester premixes with respect to variables in the molding process itself. This study of transfer and compression molding of premixes showed how differences in physical properties affected structures of molded parts. Such information tends to improve the performance of plastic materials in components. While this does not necessarily represent an improvement in material, it is likely to lead to improved materials as the study of fabrication problems and physical properties continues.

Polyester resin filled with ammonium perchlorate and graphite formed a series of resins which are combustible and electrically conductive. When 50% graphite was used; the conductivity was high, but the combustibility was not satisfactory. Combustibility and conductivity were supplied by a mixture containing 20% ammonium perchlorate and 30% graphite. This work was reported by one of the arsenals in development material for missiles.

Polyester films have been finding more and more applications where they can display their specific properties to advantage. A two-mil thick Videne film, embossed and laminated over black, rigid polyvinyl chloride was laminated to wood furniture. This reduced the wood finishing cost by 35%, and the chemical resistance and beauty were obvious advantages for such items as bar tops, the application in which the laminate principally was used. One polyester film expansion announcement was made by DuPont as a 30% increase, ready in 1960.

Films

The SPI led a very effective safety program in connection with the use of thin polyethylene film. Television trailers were made to show how to destroy the film as soon as it is through doing its intended work in covering freshly-cleaned garments, for example. The cost of the program was paid by producers and converters of the film, in an equitable arrangement administered by SPI.

The Food Additives Amendment had a serious effect upon the development of plastic films for use in the food industry.

Polystyrene film continued to increase in use and a polyvinyl fluoride film appeared under the name Teslar. This material was introduced by DuPont, and showed excellent outdoor weathering, as measured by the number of years of outdoor exposure to reduce elongation to 10%. The polyvinyl fluoride film indicated from accelerated tests that it would take seven years to reduce elongation to 10%, whereas Du Pont's Mylar brand of polyester film reduced to 10% elongation in four years, according to the report.

Research and Development

Research and development in the plastics field, even if limited to that which has to do with material, is a very large subject. However, a number of interesting items seem to be worthy of recording in this summary of developments in materials. The International Standards Organization (ISO) Plastics Committee, which is Technical Committee No. 61, met in Munich in October 1959. The fundamental properties of plastics of all kinds were discussed, and 800 nomenclature and definition items were adopted. Task groups were appointed to look into almost everything imaginable which ought to be subjected to international standards. In view of the fact that plastics are probably more universal in their international travels than money, the work of the ISO is especially important to the plastics industry.

The Manufacturing Chemists' Association is sponsoring basic research in the behavior of plastics in the solid state at Case Institute of Technology. This work is being done under an annual grant, and it represents an area which has not yet been investigated thoroughly.

The possibilities of using nuclear energy continue to interest people in the plastics industry. Great expectations in the realm of polymerization and curing have existed for a long time. Although nuclear energy appears to be in rather limited use at the present time, a great deal of work is going on in many research laboratories.

Impact testing of plastics is a subject which has been extensively studied for many years, and the standard Izod test continues to be difficult to dislodge as the basic criterion of impact strength. A number of people have been using the falling dart or falling ball test as a more practical means of determining the weak points of plastic materials. This test does not provide every advantage which design engineers would like to have, but it is creeping into data sheets on plastic materials as a portion of the physical properties description. Perhaps, in time, it will become well enough known to indicate instantaneously the relative impact strength of a material when it is described by the falling ball-drop impact test.

(Continued on page 50)

Reinforced plastics Do you remember those "Good Old Days"?

Edited by: HARRY T. DOUGLAS

The other day, after taking some VIPs through our custom-molding plant, I received the usual comment generally delivered in a patronizing tone, "Wonderful —but there is so much hand labor!" Of course, it is very true that labor forms an uncomfortably large part of the factory cost of our products. This is true particularly in contact and bag molding and, to a lesser extent, in mated-die work. But lest we despair of the amount of progress we have made, just take a short return trip to the "good old days".

"Good old days?" Do you remember when the favorite laminating resin for vertical wall radomes was Laminac 4201? We used it because it was so sticky and viscous that it would stay on vertical surfaces long enough for us to apply a vacuum. But what viscosity! It was necessary to have a man report for work an hour before the regular crews in order to hack some resin out of the drum and get it into a double boiler to reduce the viscosity. At that, it was like wetting cloth with taffy.

There was a fair amount of cloth available, but most of us were such poor credit risks that we had to pay the weavers before they would start the looms! Then, we would wrestle the stuff to a treatment plant and finally to our own plants to use in manufacture. How we welcomed the first mat as a chance to widen our markets by using lower-cost reinforcement!

Now about honeycomb? All of us bought it from Western Products Co., and was it ever expensive! It was received in slabs or blocks, and it was necessary for us to slice it into the proper thickness ourselves. Each time we took a few slices off the slab, we carefully returned the remainder to the vault. For vacuum bags, we all used cellophane for some time before we discovered polyvinyl alcohol film made by the Resistoflex Co.

Fabrication problems were tremendous. Do you recall the frantic search for parting agents? Very often, we were tempted to ship our products still firmly-cemented inside the molds. I remember the removal operation on a large radome called for 10 men in one whole day, driving spring-steel skewers between mold and part, when finally with an explosive "crack" the part came free. I remember, too, daring to use one of the highly-heralded silicone parting agents on a 26-foot surf boat, and how we removed the mold from the part in sections with the help of four 20-ton jacks. Facilities? Those jacks were indispensable in providing breaking pressure on one of our early toggle presses which, having a mind of its own, seldom landed twice in the same place. And do you remember the early ovens used in the industry, the asthmatic vacuum pumps, and tired compressors?

Going one flashback further, do you recall when almost everyone and his brother dreamed of making a fortune in the new frontiers of fiber-glass laminating by producing gunk products in his garage or basement? All they needed was a mold, the raw materials, very little talent, and plenty of nerve—they already had the garage. And what about the time you could go to work in a crumpled T-shirt, without any concern about how the "corporate image" looked, and whether or not your tie matched your socks? When you had only three employees, you had no labor or union problems, no need for labor counselors, management and public relations advisors, marketing experts, and courses on public speaking. (The fellow across the floor could hear you swear loudly enough when someone forgot to wax the mold.)

All in all, while we are a long way off from mass-production methods and really low-cost materials, we have come a long, long distance in the amount and quality of materials available to us today, in the techniques we have perfected, and with the facilities in which we construct our products. Perhaps the main thing to remember about "the good old days" is that although we didn't make much money, we did have a barrel of fun.

—THE END

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Compression & transfer molding

When quality is more important than price!

Edited by: PAUL E. FINA*

Molders of missile and rocket insulation-liner parts are not taking chances these days. Not when material costs run from $3.00 to $30.00 per pound, and a charge load weighs up to 120 pounds. Only a molder with advanced knowledge of the factors affecting the molding operation can qualify. It is possible that the additional experience attained in molding these compounds successfully will bring a new era of precision thermoset molding into the plastics field. If every step along the way is right, the very first shot can be perfect! There are many factors to be considered in order to engineer perfectly any proposed molded part from conception to ultimate use. No one engineer can qualify and no one company has the total information required. The designers, compounders of materials, tool engineers, die makers, molding technicians, and inspectors must understand each other's problems and pool their knowledge. Withholding contributive information from each other would only serve to delay progress.

Several molders have expressed their desire to become familiar with what knowledge is involved in molding good missile or rocket liner parts. The same knowledge might be applicable to other high-quality large parts. In outline form, here are the salient factors affecting the quality of the molded part:

Part Design—maximum cross-section or thickness, draw depth, configuration, variable sections, tolerances.

Material Formulation (molding compound)—resin system and resin content, fillers, catalysts, inhibitors, additives, etc.

Material Control—plasticity (soft to hard flow), duration of flow, volatile content, bulk factor, etc.

Mold Design—a complete subject in itself.

Molding Conditions—temperatures, pressures, preforming, type of heat, type of press, controls, regulators, etc.

Molding Technique—pre-conditioning, preheating, loading, degassing, closing time, degree of cure, and cooling.

Field Requirements—control of properties, ultimate properties, density, mechanical strengths, tolerances, electrical insulation, chemical resistance, heat resistance or ablation.

Field tests—heat stability (continued curing or afterbake), electrical properties, surface hardness, molding temperature, water absorption (dimensional growth and weight increase), after-shrinkage, etc.

Specifications

Upon the investigation of a rocket-liner specification sheet, it can be noticed that a series of controls have been instituted. They are for resin content, volatile content, plasticity range, bulk factor, specific gravity, filler size, minimum mechanical properties, cure tests, and X-raying.

The molder must be aware that all his technical faculties must be brought into force. He must prepare himself to inspect carefully all incoming materials, tools, and components. He must be able to completely control his molding techniques and conditions. Finally, he must be set up to inspect and check out the molded part. It may be noted that many molders who have been quality conscious will consider the aforesaid as standard operating procedure.

For the edification of the molder, let us briefly delve into the practical consequences stipulated in the above specifications, and determine the reason for their inclusion:

Resin Content: A variation in resin content will alter the specific gravity, the molding pressure requirements, the mechanical properties, the shrinkage and, of course, will vary the charge weight to be used.

Volatile Content: An inconsistent volatile content will affect flow properties, alter molding pressure requirements, change breathing and degassing or degassing techniques, can cause the cure time to change, and can result in a need to correct the charge weight.

Plasticity: The flow of a molding compound must be held within a narrow range (cure shrinkage, molding pressure, preheating, etc., are uncontrollable).

Bulk Factor: This item may not seem important

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until the consequences due to its variation are noted. When the bulk factor varies drastically, loading becomes a problem. This, in turn, alters the heat transmission during molding. The slower the heat transmission, the more is the initial pressure required to mold. Pressure changes cause a variation in shrinkage. Preforms are not the total remedy in overcoming bulk factor. Due to bulk factor, the hardness of the preform can change. Even the amount of preheat developed in preforms may vary enough to affect molding pressure, flow time, etc. Also, the use of preforms sometimes causes molded knit or non-weld lines which detract from mechanical properties.

The closer the control of all the elements involved in molding, the more precise the parts. The molder of missile insulation-liners has learned that absolute control is impossible and impractical. Therefore, he has re-developed an old method used in molding that has previously served him well. This method is not concerned with reducing cycles, but in reducing rejects. When molding expensive parts, rejects are a more serious problem than the additional time in the press. One of the accepted methods used in molding when optimum properties and control are essential is described below:

A Controlled Molding Method

Assuming that the part and mold design are not in question and that material control is established, then the molding conditions and techniques remain to be controlled in order to obtain the optimum properties. The molder contributes by utilizing the following eight-step method:

(1). Material is pre-conditioned (at a temperature range of 110-140° F.) to desired volatile content.

(2). Material is strategically loaded at about 150° F., since balanced distribution is essential for best dimensional control and optimum mechanical properties.

(3). Press is closed to full calculated pressure; one loading is best so as to avoid non-welding or poor integration of material.

(4). Heat is turned up and temperature is brought quickly up to the point of maximum flow without polymerization. A dwell-time is established. This dwell will tend to eliminate gasses of reaction, further improve uniformity of distribution, and cause a completed flow without danger of setting-up (or gel).

(5). At end of recommended dwell, temperature should be quickly brought up to curing temperature.

(6). Cure time. This should have been established prior to molding by simulating conditions in laboratory molds.

(7). At end of optimum cure time, cool mold back down to original loading temperature. It may be desirable to maintain pressure, and there is no better shrink fixture than the mold itself.

(8). Remove part and make ready for next molding.

Conclusions

As indicated at the beginning of this article, molders of missile and rocket insulation-liner parts are not taking chances these days. They know that unless optimum properties have been obtained in the molded parts, a true evaluation cannot be attained. The pooling of knowledge between designer, tool maker, material manufacturers, and molder is essential. While the controlled molding method described may not seem practical, it is producing dependable results. As the technology advances, more efficient methods will be derived. Certainly, precision molding is worth investigating.

—The End

Advances in plastics materials, 1959-60
(*Cont'd. from page 47*)

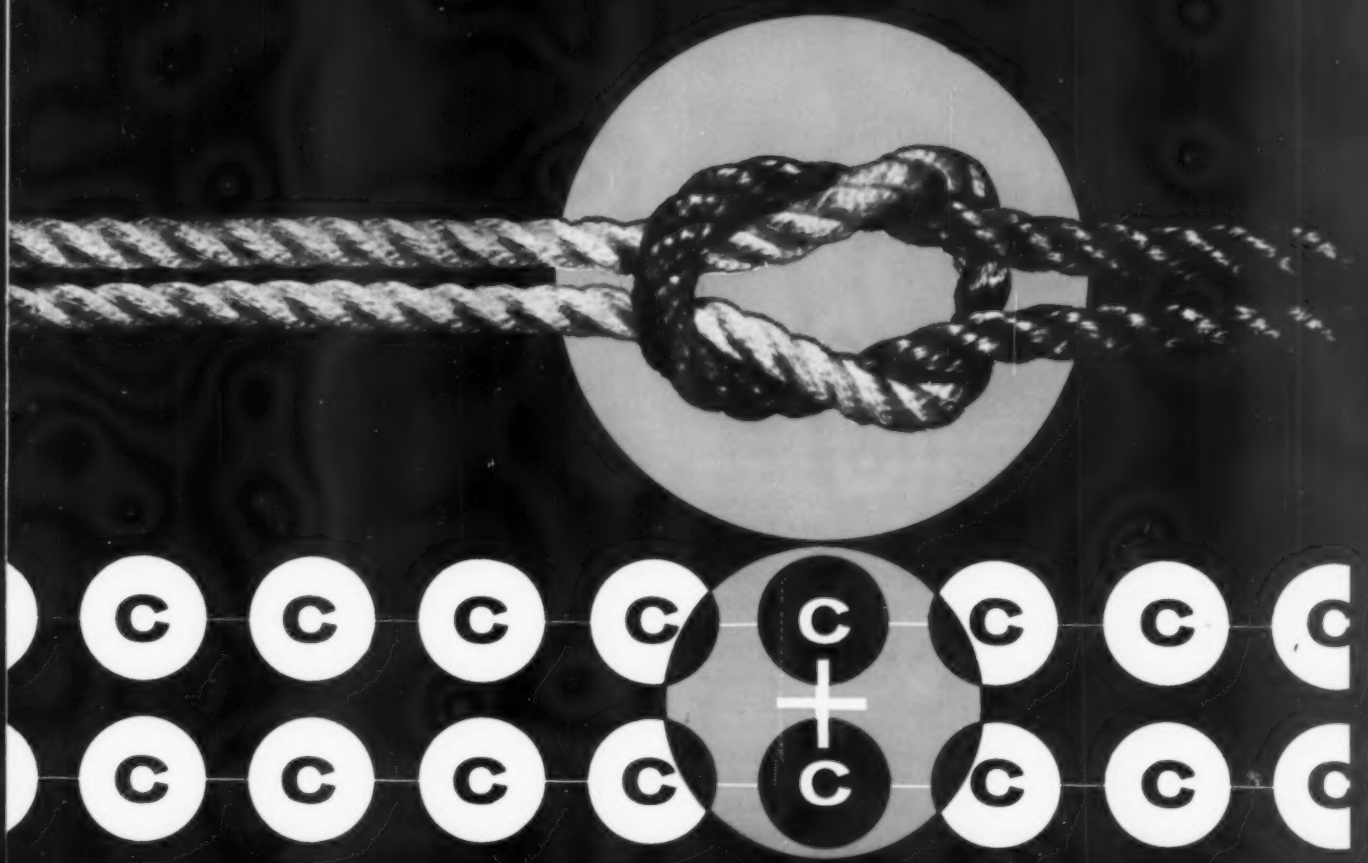
Industry Notes

The Society of the Plastics Industry polled its member companies with regard to their expansion plans during 1959. The consensus was that a large majority of the companies are planning to expand. U.S. production of plastics materials is estimated at 2,800,000 tons. But estimates, like women, are flighty and unpredictable; tomorrow may not hold what today implies.

American companies seem to be branching out into foreign sales and manufacturing operations increasingly. It has been suggested that the domestic plastics industry could very well be among the leading U.S. industries in this type of foreign growth. A study of trade papers serving other industries indicates that while plastics may not be first in foreign activity, it truly is among the industries leading the way.

Industrial applications of plastics have always existed in large volume. Recent trends have shown very large increases of plastics usage in automobiles, household appliances, textiles, electronics, and vending machines. These industrial fields seem likely to double or triple their usage of plastics within a very short time. In some cases, the increase of plastic will be considerably more than three times the present use, but it is too early to catalog these increases at the present time. One of the encouraging factors in this regard is the high degree of interest displayed by product engineers and manufacturing engineers in learning all they can about the properties of plastics so they may be correctly designed and fabricated for maximum utilization of the inherent physical properties. Professional societies in all fields show high interest in inviting plastics people to talk to them about the plastic materials and how to use them well.

—The End



DI-CUP . . . *The Chemical Way to Cross-Link Polyethylene*

Di-cup, Hercules dicumyl peroxide, is a source of free radicals, which are highly effective in chemical cross-linking. It provides a simple, economical, and practical means of cross-linking low-density polyethylene.

Cross-linked polyethylene is a thermoset material resistant to softening and deformation at high temperatures. It shows no evidence of environmental stress cracking and it is resistant to many solvents at high temperatures.

This development opens new markets for products that require superior toughness, flexibility, impact strength, and chemical resistance.

For more information on Di-cup, write

Oxychemicals Division
Naval Stores Department
HERCULES POWDER COMPANY
INCORPORATED
900 Market Street, Wilmington 99, Delaware

N-060-2

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

"Standardization . . .

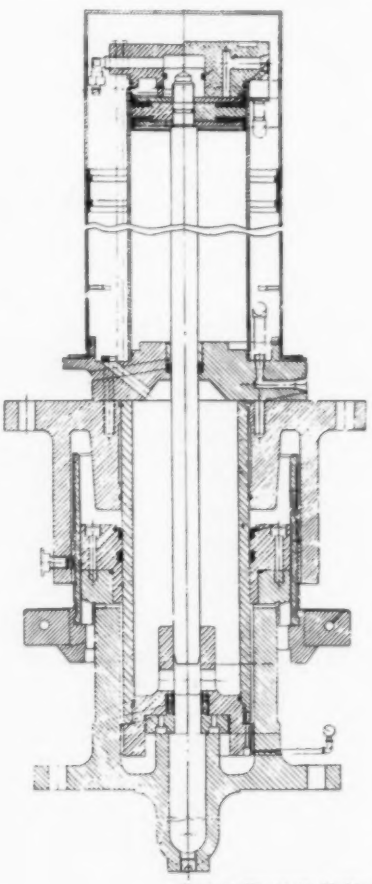
. . . what's in it for me?"—is the question most frequently asked by machinery builders when hard competition calls for a re-evaluation of production costs. Posed by management, it inevitably results in a brainstorming session by all departments in which uncensored thinking is encouraged. The outcome of this type of discussion will generally prove that savings based on standardization accrue in smaller storage inventories, lower costs through quantity buying, simplified operations, and a reduction in man hours of work. This, in essence, holds true whether a firm is manufacturing machines or hardware, housewares or chemicals, or sewing needles.

Interchangeability is the key to mass-production. But to adapt this for highly specialized or custom-built machines, in the one-of-a-kind category, could well be considered a real accomplishment. I have noticed that many machinery builders for the plastics industry have been slowly following this trend. There are still some manufacturers who claim that standardization impedes progress and that drastic design changes bring about greater improvements. While theoretically possible, this is a very costly move and, in the long run, accomplishes no more than normal evolution of machine design. The latter allows for proper amortization, thereby bringing down the cost of specialized machinery. Evolution in this sense implies the modification of a standard so that the new is interchangeable with the old.

Recently, I paid a call on Joseph Swick, president of Tronomatic Machine Mfg. Corp., in New York City. He pointed out that standardization was effectively employed by his company to consolidate its inventory of power-heads and spare parts. He showed me the units in all stages of manufacture, from the raw castings to the units newly installed on finished machines. He also explained, that by standardizing on the design of the unit, the company was able to purchase larger quantities of hardware and component parts at a reduced cost. He further said that the number and type of machining operations were substantially reduced from those required for dissimilar power-heads.

The accompanying diagram shows what Tronomatic has done toward this end. Two sizes of a standard design for a power-head are made to fit many types of presses. They are used on trimming presses, on expanded styrene presses, on pressure-forming presses, and on large heat-sealing presses. These two sizes encompass the tonnage capacities of the various presses mentioned.

These power-head units are self-contained, air-over-oil, pressure amplifiers known in hydraulic parlance as "pressure boosters." They operate in one direction, only, for the power stroke, and need the assistance of pull-back cylinders to return them to a starting position. In an operating press, the double-acting, air-actuated pull-back cylinders are used to raise and

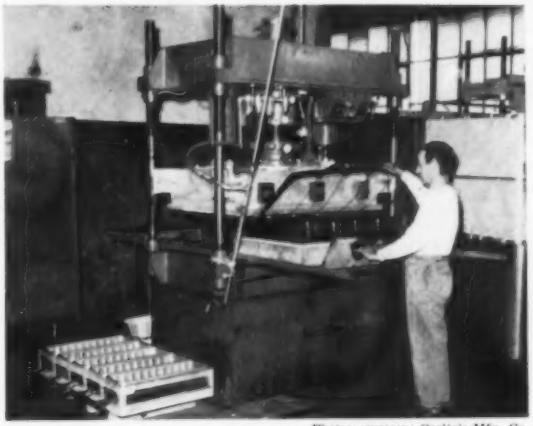


Courtesy: Tronomatic Machine Mfg. Corp.

Power-head diagram.

Photos courtesy: Carlisle Mfg. Co.

Trimming mold moved under heated knives.



Photos courtesy: Carlisle Mfg. Co.

Removal of scrap after trimming.

Note: Thermoforming mold at base of machine.

lower the movable platen at controlled speeds. After the pull-back cylinders have moved the platen downward to within ⅜-inch of the preset (closed) position the power-head takes over to complete the stroke. Here, it supplies the work force typical of all high-pressure rams. The closed position on the press is preset in the pressure-head by an adjustable, mechanical stop (integral micrometer screw). This entire operation is automatically sequenced and cycle-timed.

Re-stated, standardization can be a great benefit rather than a hindrance to progress when multiple production of standard components save engineering, design, and machining time, while decreasing the number of spares that need to be stored. All this also reflects back to a manufacturer in an overall savings which can be applied to a reduced selling price and/or an increased margin of profit.

The photos accompanying this column show Tronomatic trimmers in actual production at Carlisle Mfg. Co., Newark, N. J.

Photos courtesy: Carlisle Mfg. Co.

Trimming mold moved back—finished parts removed.

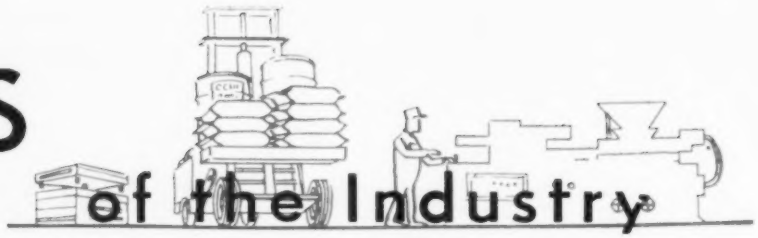
Charles Fader, President of Carlisle, informed me that the items are plant-boxes manufactured from 115-mil, high impact styrene. These boxes are proprietary items, vacuum-formed on an Auto-Vac machine, trimmed on a Tronomatic unit. The size of the vacuum-forming machine is 30 x 50 inches. The sheet is a gold laminate, 26 x 44 inches from which five 24 x 6 x 6 inch boxes are shaped. The material is heated in close proximity to top heaters set at 1,125° F. for 42 seconds. A cold plug is lowered and enters the female cast-aluminum cavity for a distance of 1½ inches traveling at a slow rate. At this point the vacuum is drawn on the mold. Being cold, the plug sets the bottom and a portion of the sides of the partially-formed box, thereby controlling thinning of the material at the bottom corners. After the boxes are completely formed, they are cooled for 12 seconds by circulating water at a controlled temperature of 90° F. through the mold. The total cycle time is one minute 40 seconds.

While still warm, the shaped matrix is transferred from the vacuum-forming machine to the die of the trimming machine. This die is then positioned under the movable (upper) platen of the press in which the trimming knives are mounted. The upper platen, automatically heated to 225° F., transfer this heat to the knives. When the knives contact the material, the platen dwells for a seven-second period after which the heated knives are pushed through to a ⅛ penetration. From this point, the knives continue to melt through the material leaving polished edges on the boxes.

Mr. Fader encountered no shrinkage or distortion problems during cooling when all boxes in the matrix were simultaneously cut. He further pointed out that when the boxes were individually cut, it was impossible to control the proper registry of the knives with the edges of the box.

Carlisle Mfg. Co. has entered the plastics industry through its previous experience in dip-coating steel items. It has since expanded into polyester-fiberglass, and injection molding operations. —THE END

NEWS of the Industry



business developments

Archer-Daniels-Midland's spray-up system is being used at the Osaka, Japan, trade fair to form a tough coating of plastic and colored rock particles over a concrete base on the main traffic areas of the American pavilion. Last year, the American exhibit in Moscow had an unprotected concrete floor which was churned to powder under the visitors' feet.

Commercial Plastics & Supply Corp. of New York City has established an export sales division. The firm's fabricating and manufacturing subsidiary is Comco Plastics, Inc.

Horkey-Moore Associates has formed a plastics division for the fabrication of reinforced plastics structures for high temperature use: missiles, aircraft, and space vehicles. Carl S. Seybold will direct the operation.

Interplastics Corp. has made available high-quality reprocessed polyethylene film in dense, pellet form.

Albi Mfg. Co., Rockville, Conn., has formed a plastics applications division for the development of fire-retardant coatings for plastic components and products.

news from abroad

Czechoslovakia. Imperial Chemical Industries has sold patent rights for Terylene to a Czech producer for £220,000.

Switzerland. News that fly maggots may be able to assimilate polystyrene, probably through the solvent action of larval secretions.

Greece. The first polystyrene plant in Greece is being erected by a wholly-owned subsidiary of Dow Chemical Co. The plant will cost about $1-million, and should begin production by early 1961. Imported raw material will be used.

Dow Chemical Co. has a $12-million project in the works at Plaquemine, La., including a high-pressure polyethylene plant. Completion is scheduled for this fall.

Italy. Polyamide fibers and textile shreds are used to fill phenolics and, since they partially dissolve during molding, act as a plasticizer as well as a reinforcement. Such compounds feature ease of molding, good electrical and mechanical properties, high elasticity, and low water absorption. Suggested applications include typewriter covers, sewing machine rheostat housings, special electrical switches, and motor housings.

changes in ownership, new companies

Celanese Corp. of America has purchased Plastic Horizons, Inc., a major producer of polyethylene film with plants in Paterson, N. J., and Batavia, Ill.

Haveg Industries, Inc., has purchased Blow-O-Matic Corp., Bridgeport, Conn., and will operate it as the blow molding division of Haveg Industries. This should eliminate whatever confusion exists with the Blow-O-Matic machine, which is made in Denmark and distributed in the United States by Rainville Co. Inventor of the machine, Soren Graae, had been the owner of Blow-O-Matic Corp.

York Industrial Plastics, Inc., is a new firm located in York, Pa. It was licensed by Sud-West-Chemie of West Germany to extrude and fabricate thermosetting plastic materials. The firm will offer a complete line of pipes, fittings, valves, and pumps lined with Bascodur, a thermoset with high heat and chemical resistance.

Stolper Steel Products Corp., has purchased Plasticon, Inc., El Monte, Calif. Stolper also plans to establish another reinforced plastics operation at its main plant in Menomonee Falls, Wis.

Reichhold Chemicals, Inc., has acquired Deecy Products Co., Cambridge, Mass., manufacturer of plasticizers. Reichhold also obtained the stock of Modiglass Fibers, Inc., held by Nicolet Industries, Inc.

Allied Chemical Corp. has acquired Specialty Resins Co., Lynwood, Calif. The move will give Allied's plastics & coal chemicals division its first production facility on the West Coast for resins and plasticizers.

Borden Co. and **U. S. Rubber Co.** have formed a jointly-owned chemical company to be called Monochem, Inc., which will erect a plant in Texas or Louisiana. This plant will use hydrocarbons such as natural gas or low flash points fuels as starting points for the production of acetylene and vinyl chloride monomer. Both owner firms will erect separate plants adjacent to the Monochem unit, and will utilize the entire output.

Dayco Corp. (formerly Dayton Rubber Co.) has formed Dayton Dayflex Plastics Co., to absorb all of the operations of the former Dayflex plastics division. In addition, the new firm will develop, test, and manufacture other plastics products.

Applied Research & Development Corp. is a new firm located in Chippewa Falls, Wis., founded by David Hancock, former director of research for Chippewa Plastics. AR&D is extruding expandable polystyrene foam and acting as a consulting and product development service in this area.

Key Polymer Corp. has been formed by J. Lichman, S. Comins, and A. Comins to produce adhesives and coatings from epoxies and polyurethanes. Location of the firm is 135 Bradford St., Lawrence, Mass.

Flintkote Co. has obtained all outstanding stock of the Sealzit Co., Riverside, Calif., for more than $1-million. The latter firm makes guns and accessory equipment for the application of resins, binders, and other materials.

Thermoplastic Equipment Corp. has been activated as of the first of this year and is now manufacturing the Vertical 1250-B extruder for use with two-color items. The Stirling, N. J., firm wil also produce dies and extrude tubing.

Princeton Chemical Research, Inc., has been set up as a contract research and development firm, with headquarters in Princeton, N. J. The founder, C. Wolf, is the former research manager for PetroTex's Princeton labs.

changes in corporate name

The Enjay Co., Inc., has become Enjay Chemical Co., a division of Humble Oil & Refining Co. Enjay becomes directly responsible for both the marketing and coordination of Humble's chemical products activities throughout the country.

International Molded Products, Inc., has changed its name to **Brookpark, Inc.** The new office building is located at 11701 Shaker Boulevard, Cleveland, O.

agents, distributors & agreements

Ultrasonic Industries, Inc., Albertson, N. Y., and Industrikeme A/S of Denmark have concluded agreements for the mutual distribution of each company's products in their respective countries.

Dow Chemical Co. has appointed Berton Plastics, Inc., New York City, as distributor of its styrene monomer to the reinforced plastics field. Berton also distributed glass fiber, polyester resins, and catalysts in the eastern area.

Muro Plastics Co., Seattle, Wash., is now the exclusive representative for Modern Plastic Machinery Corp., in Alaska, Idaho, Hawaii, Montana, Oregon, Utah, Washington, Wyoming, and Western Canada.

Applied Engineering Co., Inc., Orangeburg, S. C., has been named sales representative in the Carolinas and Georgia for NoVo Metering & Mixing systems, a product of the Mitchell Specialty division, NoVo Industrial Corp., Philadelphia.

General Latex & Chemical Corp., Cambridge, Mass., has appointed King Chemical Corp., St. Louis, Mo., as distributor for Vultafoam, its new polyurethane foam. King will service the midwestern and western states.

Reichhold Chemicals, Inc., was issued the first license for the in-situ epoxidation process developed by the Becco Chemical division of Food Machinery & Chemical Corp.

Whitlock Associates, Inc., has named the W. K. Nelson Co. of Minneapolis as its sales representative in Minnesota and Wisconsin. Whitlock manufactures pneumatic and vacuum conveyors and dehumidifying dryers.

new plants, labs & additions

Northern Plastics Corp., LaCrosse, Wis., has scheduled a 6,000 square-foot addition to its plastic laminates plant.

Nopco Chemical Co. has acquired a process and has completed plans for the production of isocyanates. To be located in New Jersey, the plant will have a capacity of 10-million pounds, expandable to 20 million. John Steinke will be project manager, and the facility should be in production by January, 1962.

Hooker Chemical Corp. has announced plans for the construction of a phenol plant in Argentina, to be owned jointly with Atanor, an Argentine chemical firm. A new company, Duranor, was formed earlier this year to manage the operation.

Spaulding Fibre Co. has announced plans for a major addition to its fabricating division at Tonawanda, N. Y., as part of a $1¼-million expansion program for 1960. The firm manufactures vulcanized fiber, laminated plastics, and fiberboard.

Frank W. Egan & Co. plans to double its main plant facilities through the addition of 30,000 square feet of working space. The two-story addition will be of brick and cinderblock construction.

Enjay Chemical Co., a division of Humble Oil & Refining Co., opened its Escon polypropylene plant in Baytown, Tex. Initial capacity is 40-million pounds annually, with provisions for expansion to 100-million.

Minnesota Mining & Mfg. Co. will double the size of its Buffalo branch office and warehouse by October.

Phillips Chemical Co. plans to construct an additional ethylene plant at Sweeny, Tex. Completion is scheduled for fall of 1961, and will double capacity to 580-million pounds.

Koppers Co., Inc., is expanding its polystyrene facilities at Kotuba, Pa., by about 15%. The firm's expanded polystyrene-cored panel plant in Detroit is now in operation.

Borden Chemical Co. is building a new product development laboratory and a dry adhesives plant, coupled with further expansion of resin and formaldehyde production at Springfield, Ore. The project involves a capital investment of over a million dollars.

General Electric's chemical materials department is near completion of its polycarbonate resin plant near Mount Vernon, Ind.

Tri-Point Plastics, Inc., is erecting a 15,000 square foot plant in Albertson, N. Y., adjacent to its existing plant. The addition will triple the firm's existing fluorocarbon extrusion capacity, and will provide for molding-forming operations on standard and newer Teflons.

Flightex Fabrics, Inc., New York City, has opened a fiberglass weaving and finishing plant in Pawcatuck, Conn. Complete customer-service laboratories will be available to the industry.

American Cellular Corp. officially opened its 10,000 square foot plant at 8501 Southwest 129th Terrace in Miami. Products will include encapsulation and contour packaging, foamed and cellular cored structures, and foam products.

Escambia Chemical Corp. has completed its facilities for producing methacrylic acid and methacrylate esters by isobutylene oxydation. The plant is located in Pensacola, Fla.

Swartwout Division, Crane Co., has moved its production facilities and headquarters from Cleveland to Hooksett, N. H. The firm manufactures electronic process control instrumentation.

Owens-Illinois Glass Co. opened a plant in Los Angeles for the production of semi-rigid plastic containers, and plans to open other plants in Toronto, Chicago, and Cincinnati.

PLASTIC COATED CUPS · FOOD WRAPPINGS · FATTY FOOD CONTAINERS

WHEN YOU CAN'T AFFORD A "QUESTIONABLE" PLASTICIZER... when your plasticizer must be safe, nontoxic and economical, Pfizer Citroflex® A-4 is your best bet. ■ Especially suited for use in plastic coatings, packaging films and plastisols, Pfizer Citroflex A-4 is odorless as well as nontoxic. And it has been accepted by the Food and Drug Administration for use in packaging for both fatty and non-fatty foods. ■ CITROFLEX A-4 (Acetyl Tributyl Citrate) shows excellent results in plasticizing vinyl films for meat wrapping, vinyl coatings for food containers and hot drinks cups and vinyl plastisols for bottle crown liners and food jar sealing rings. In addition, Pfizer Citroflex A-4 is excellent in polyvinyl acetate adhesives. ■ Remember, for non-toxic, efficient, economically-priced plasticizers look to Pfizer first. ■ Write for Technical Bulletin #31, "Citroflex® Plasticizers."

USE SAFE, NONTOXIC Pfizer CITROFLEX® A-4*

*Accepted by the F.D.A.

Manufacturing Chemists for Over 100 Years **Chas. Pfizer & Co., Inc., Chemical Sales Div.** Science for the world's well-being

630 Flushing Ave., Brooklyn 6, N.Y. Branch Offices: Clifton, N. J.; Chicago, Ill.; San Francisco, Cal.; Vernon, Cal.; Atlanta, Ga.; Dallas, Tex.; Montreal, Can.

Names in the News

Erie Engine & Mfg. Co., Erie, Pa., is under new management as follows: president, **S. N. Bolling;** vice president, **Bernard Sobieraj;** general manager, **R. E. Weller;** and sales manager, **Thomas Kramer, Jr.**

Robert C. Schroeder has been appointed manager—film and sheeting for Union Carbide Plastics Co. From the New York office, he will direct marketing of all flexible calendered vinyl film and sheeting. Before his promotion, Mr. Schroeder was a market manager in the product-marketing section of the sales department.

Howard A. Smith

Howard A. Smith, who joined Emerson & Cuming, Inc., in 1958 as New England district sales manager, has recently been appointed national sales manager. As such, he is responsible for all sales efforts of the company.

Robert D. Fletcher, until recently an industrial sales representative for Kordite Co., has been named district sales manager for the industrial division. He has been with the company for two years.

Henry W. Willard has been moved up to production manager of the mechanical goods division at U. S. Rubber Co. He succeeds **Howard K. Norris,** who has just been appointed marketing manager of the division. For the past eight years, Mr. Willard has been factory manager at Passaic. He will supervise plant production and product development at Philadelphia, Passaic, and Sandy Hook, Conn.

John T. Moore has been named an assistant sales manager, and **John Adams,** manager of polyethylene sales development, in the plastics division, Eastman Chemical Products, Inc. Mr. Moore, who was previously in charge of the Tenite plastics sales office in Leominster, Mass., joined Eastman in 1941. Mr. Adams, with Eastman since 1953, was a sales representative in the Chicago office of the plastics division.

Adolphe J. de Matteo, formerly general manager of Watson-Stillman Division of Farrel Birmingham, has opened an office in New Jersey. He is available for consultation on hydraulic presses and controls, injection molding machines, and plant layout.

Lloyd T. Moore has been named sales manager of Libbey Plastics, Inc., formerly a part of Keystone Brass Works which was purchased by Owens-Illinois Glass Co. last November. He will be responsible for sales of the company's melamine dinnerware. He is succeeded as manager of the Lake City, Pa., plant by **Raleigh H. Kinker,** technical services director at Libbey's glass tableware plant in Toledo. **Nathaniel Reyburn,** plant engineer at Lake City, has been named plastic engineer on Libbey's general engineering staff and will be responsible for the engineering phases of Libbey Plastic's development. He will continue to be responsible for the Lake City plant's engineering department.

Guy J. Robichaud, formerly chief chemist at Acton Rubber, Ltd., has started in business on his own as technical consultant to the rubber and plastic industries. His office is in Granby, Quebec, Canada.

William E. Pearson has been appointed general manager, and **Edward M. Kohtz,** general sales manager, for Molded Fiber Glass Boat Co. Mr. Pearson has been with MFG since 1957, first as eastern district sales manager, and then as general sales manager. Mr. Kohtz' experience in the pleasure boat field dates back to 1938, and includes working knowledge of the needs and problems of marine dealers and operators of boat yards and marinas.

Russell W. Buchanan has been designated production control manager of Cary Chemicals, Inc. He has had experience in many phases of engineering—sales, development, and consulting—and most recently was with Dayton Rubber Co.

John K. Townsend and **Chester E. Sanford** have been promoted, respectively, to chief engineer and plant engineer at Filon Plastics Corp. While Mr. Townsend will coordinate engineering department activities and provide technical data service to foreign licensees, Mr. Sanford will supervise all plant engineering projects. Both men joined the company in 1955.

Antone Vittone, Jr.

Dr. R. J. Wolf

R. J. Wolf has been named director of development for B. F. Goodrich Chemical Co. He succeeds **Antone Vittone, Jr.,** now general manager of plants. Dr. Wolf will be in charge of all operations at the firm's Avon Lake, O., development center, while Mr. Vittone will manage all Goodrich chemical production, product improvement, and cost control. Goodrich has also announced the appointment of **Dr. Benjamin M. G. Zwicker** as director of planning. In addition to his previous responsibility for new products planning, Dr. Zwicker will now be concerned with project analysis, patents, data handling, and computer operations.

William D. Lippmann has been designated general manager of Bolta Products Division, General Tire & Rubber Co., and **Charles L. Becker, Jr.,** general sales manager. Both men have been in executive positions with General's Textileather Division in Toledo, Mr. Lippmann as administrative assistant to the general manager, and Mr. Becker as distributor sales manager.

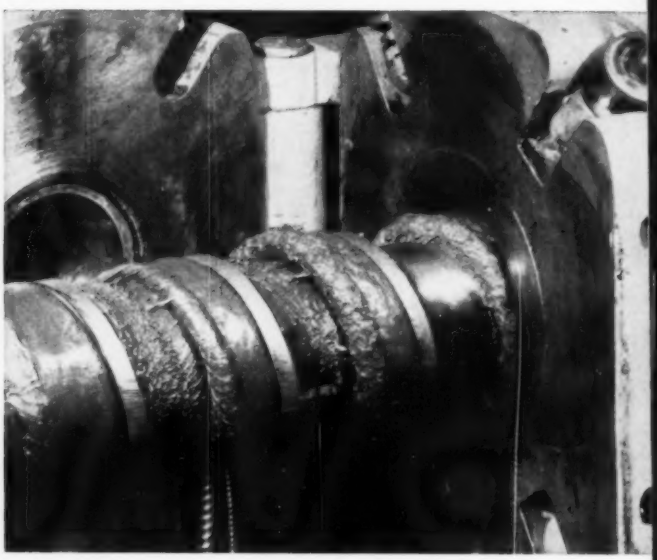
Ramon A. Mulholland has been appointed manager of the commercial development department at Richardson Co. In managing market research and development not related to present product lines, he will be responsible for helping to diversify the company's line.

T. Dean Smith has been moved up to manager of the petrochemical department of American Cyanamid Co. With Cyanamid since 1946, he most recently was assistant manager of the Fortier, La., plant.

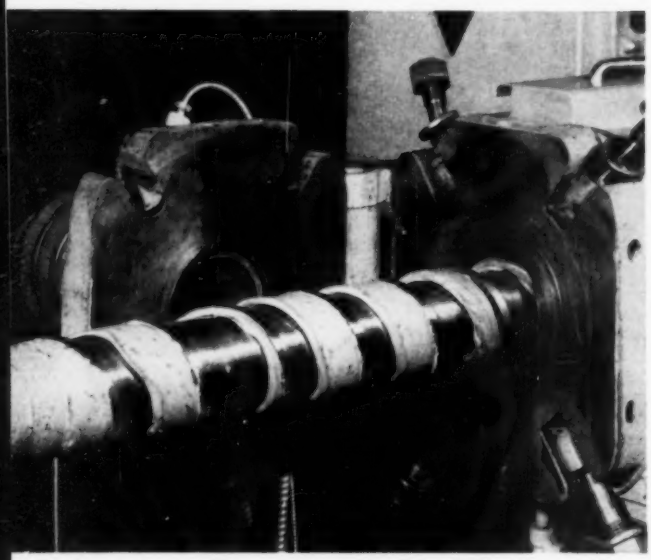
J. L. Johnson, economic evaluation engineer with Dow Chemical Co.'s Texas division, Freeport, for the past three years, has been transferred to Midland to become plastics section head on the market research staff.

now...clean your extrusion or injection machine in hours...not days...with A-C Cleaning Compound

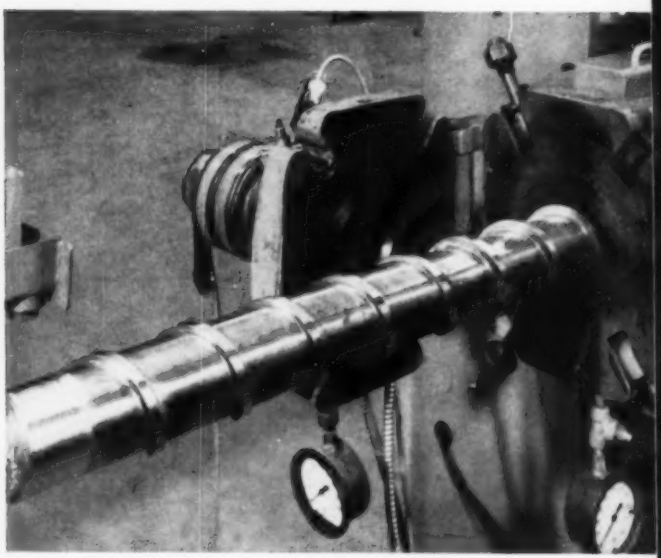
1. Empty hopper and load with A-C Cleaning Compound.



2. Operate machine to purge old material.



3. Note how A-C Cleaning Compound strips off easily.



4. In hours—not days—a clean machine ready for the next run!

If you've been losing days and dollars in making change-overs, here's good news! Allied's Semet-Solvay Petrochemical Division has now developed a cleaning compound that will completely remove any thermoplastic material—and do it in a fraction of the time normally required. The simple procedure is pictured above.

One extruder tells us that he saves $5,000 by using A-C® Cleaning Compound—cleans a machine in 1½ hours without tearing it down.

You'll find A-C Cleaning Compound speeds changing material or colors, and eliminates cylinder contamination. It purges without scratching and strips cleanly and easily from extrusion screws without mess.

For a free bulletin telling how this new cleaning compound can save *you* time and money, just write us at the address below.

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Dept. 576-B, 40 Rector Street, New York 6, N. Y.

National Distribution • Warehousing in Principal Cities

New Materials

For more information check Readers' Service Card (p. 81)

Foam Microwave Absorber

Emerson & Cuming, Inc., has announced a broadband, flexible foam, microwave absorber with low reflectivity. Eccosorb AN-W, extremely light in weight, may be used outdoors or in situations where it will contact fuel, lubricants, or hydraulic fluids. An impervious plastic film prevents liquid penetration. At the same time, the absorber may be subjected to low pressures, such as those that occur at high altitudes or in outer space, with no adverse effects.

Standard sheets of Eccosorb AN-W are two feet square and ⅛ to 2½ inches thick. Sheets may be cut and bonded to curved or flat surfaces. Physical properties of the five types of Eccosorb AN-W follow.

	AN-W72	AN-W73	AN-W74	AN-W75	AN-W77
Wavelength range, cm.	1.5*	4.0*	8.6*	12.5*	32*
Frequency range, kmc.	20#	7.5#	3.5#	2.4#	0.940#
Bands covered.	K	X, G, K	C, A, B, X, G, K	S, C, A, B, X, G, K	L, S, C, A, B, X, G, K
Power reflection, maximun, %	1.5	1	1	1	1

*and all shorter wavelengths.
#and above.

Readers' Service Item 1

Tough ABS Resin

Kralastic MM, reported to injection mold easily with good gloss finish and properties, is available from Naugatuck Chemical division, U. S. Rubber Co. MM requires no special mold techniques nor post-mold conditioning; low moisture absorption simplifies mold design.

Noted for rigidity and creep resistance unusual for a thermoplastic with high modulus, MM is supposed to retain its modulus better than any other impact plastic. Though it resists most organic solvents, it may be painted, printed, or welded. Molding cost is estimated at normal.

Specific gravity	1.07
Moisture content, %	0.35
Mold shrinkage, mil/in.	4
Moisture absorption, 24 hr., %	0.3
Abrasion resistance, Tabor CS17 wheel, mg./1000 cycles	14-15
Yield strength, psi. x 10^3	8.8
Flexure modulus, psi. x 10^3	450
Elongation, %	20
Flexural strength, psi. x 10^3	13.5
Impact strength, notched Izod, ft.-lb./in.	1.5
Rockwell hardness, R scale	118
M scale	66
Heat distortion temperature, ° F. 264 psi.	200
66 psi.	217
Heat resistance, continuous, ° F.	180
Expansion coefficient, in./in./° F. x 10^{-5}	3.2
Conductivity, btu/hr./sq.ft./° F./in.	1.80
Dielectric strength, volt/mil.	386
Volume resistivity, ohm/cm x 10^{14}	270
Dielectric constant	3.1

Readers' Service Item 2

SANDOZ
THINKS AHEAD WITH COLOR

Graphtol Yellow 4335-O

BENZIDINE-ANISIDIDE TONER

GRAPHTOL YELLOW 4335-O is a transparent, heat-resistant green shade yellow toner that is recommended for use in

Dry blending in polystyrene, polypropylene, polyethylene, nylon, etc.
Vinyl plastisols and Organisols.
Vinyl Coatings for golds, coppers, etc.
Rubber.
Floor Coverings.

General Characteristics

Transparency	Good
Strength	Excellent
Heat Stability	
For Plastic Molding Operations to 530°	Excellent
72 hours at 460° F	Excellent
Light Fastness (Masstone)	Good
Soap, Acid and Alkali Resistance	Excellent
Bleed in Vinyls	Moderate
Ease of Dispersion	
Polyethylene	Very Good
Polypropylene	Very Good
Polystyrene	Very Good
Nylon	Very Good

FOR detailed information and a color showing, call or write SANDOZ, INC., Organic Pigments Division, 61 Van Dam St., New York 13, N. Y. (ALgonquin 5-1700). Pacific Coast: Martin, Hoyt & Milne, Los Angeles, San Francisco.

Paper-Base Phenolic Laminate

Fireban X, a paper-base, mechanical grade, fire retardant laminate, has been developed by Taylor Fibre Co. Essentially a Grade X laminate with a special phenolic resin, this maroon material is recommended for structural parts in radios, aircraft, and switchgears; for terminal boards or panels; and for insulating washers. Fireban X should be used with discretion under conditions of high humidity.

Sheets 49 inches square come in thicknesses of 1/32 through 1 inch. Following are some characteristics.

Water absorption	8.0–1.10
Specific gravity	1.38
Hardness, Rockwell M	110
Operating temperature, max., °F.	
Continuous	225–250
Intermittent	250–275
Flexural strength, flatwise, psi., min.	
Lengthwise	22,000–25,000
Crosswise	20,000–22,000
Tensile strength, psi., min.	
Lengthwise	20,000
Crosswise	16,000
Compressive strength, psi., min., flatwise	36,000
Izod impact strength, edgewise, ft.-lbs./in. notch, lengthwise	0.55
Crosswise	0.50

Readers' Service Item 3

High Temperature Vinyl

B. F. Goodrich Chemical Co. has developed a polyvinyl dichloride, called hi-temp Geon, which is reported to withstand temperatures 60° above those withstood by conventional vinyls. As far as the company knows, this is the only self-extinguishing thermoplastic pipe material capable of handling hot water systems.

Hi-temp Geon is compounded to withstand operating temperatures from 180-200° F., and pressures up to 150 psi. Normal household pressure is 50-60 psi. Its weight, about one-sixth that of copper, facilitates handling, transportation, and prefabrication of plumbing systems.

Both normal and high impact compounds, similar to Type I and Type II PVC will be available.

	Normal Impact	High Impact
Tensile strength, psi., 73° F.	8,800	7,800
212° F.	3,000	2,000
Tensile tangent modulus, psi.	450,000	390,000
Elongation at yield, %	4.5	4.5
Flexural strength, psi.	17,000	14,500
Izod impact, ft. lbs./in. notch	0.8	5.0
Rockwell hardness, R	117	117
Heat deformation, 264 psi., °F.	220	215
Specific gravity	1.5	1.5
Linear coefficient of expansion, °C	7×10^{-5}	8×10^{-5}

Readers' Service Item 4

Fast-Curing Phenolic

General Electric Co.'s 12956 is claimed to be the fastest-curing phenolic molding powder available. This black, two-stage, woodflour-filled material is designed for extremely fast cure and rigid set on preheat compression and transfer moldings. Overall curing rates are reported to average 25% faster than those of competitive materials. Among products which have already been produced from the powder are cones, cams, and lamp sockets.

The powder, manufactured in standard industry flows and to a 14-mesh grind, has an apparent minimum density of 56. Molded parts should not be exposed to temperatures over 300° F.

Izod impact, ft.lb./in. notch, min.	0.30
Flexural strength, psi., min.	11,000
Flexural modulus, psi.	1×10^5
Tensile strength, psi., min.	6,800
Compressive strength, psi., min.	30,000
Hardness, Rockwell M.	109
Heat distortion, ° F.	320
Dielectric strength, 60 cycles, 25 C, short time, VPM	320
Power factor, 60 cycles, dry	0.10
1,000 KC, dry	0.06
Dielectric constant, 60 cycles, dry	8.7
1,000 KC, dry	5.2
Volume resistivity, ohm/cm	1×10^{10}
Insulation resistance, megohms	1.6×10^6

Readers' Service Item 5

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New Equipment

For more information check Readers' Service Card (p. 81)

Insulated Band Heaters

Industrial Heater Co., Inc., has announced the availability of a line of ceramic insulated band heaters reported to meet the demands for higher processing temperatures in the plastics industry. Heat transfer is by radiation, in contrast to conventional conduction heaters. Thus, the temperature of the resistance wire is not affected by the part being heated or the manner in which the heater is installed. Pressure on the heating surface is not required. Service life is reported to exceed 15,000 hours.

The heaters are manufactured to specification in diameters from 1½ inches up in any fractional increments, and in widths from 1 inch up in ½-inch increments. Ceramic band heaters are particularly recommended when watt density of 40 watts per square inch is required.

Ceramic insulated band heater.

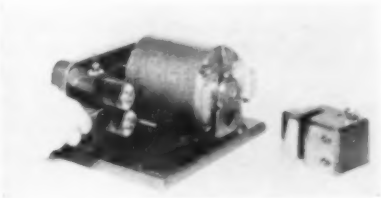
Readers' Service Item 21

Film Insulation Stripper

The Carpenter Model 12 twinwheel wire stripper, a power driven wire stripping machine designed for the removal of film and bonded insulations, is reported to remove all types of film insulation without damaging the conductor. The stripper handles sizes AWG No. 17 to AWG No. 45—either single or stranded electrical conductors. Fiberglass or wire stripping wheels are 1¼ or 1½ inches in diameter, and one or two inches wide.

According to Carpenter Manufacturing Co., Inc., the stripper can be adjusted to meet every type of insulation removal requirement. Space and pressure regulator screws are accessibly located on top of the stripping head.

Height from bench to the point of tangency of the stripping wheels is four inches. Width is 9½ inches; depth, 11 inches; and height, 6¼ inches.



Heavy duty twinwheel wire stripper.

Readers' Service Item 22

Transfer Molding Presses

A series of automatic transfer molding presses, in 50-, 75-, 150-, and 300-ton capacities, has been developed by the plastics molding equipment division of F. J. Stokes Corp. The series includes Model 741, in the three smaller capacities, and Model 743, a 300-ton unit.

Both models have been designed for maximum flexibility and versatility in use. The controls are arranged so that the presses can be operated continuously on an automatic basis, or intermittently on a manual or semi-automatic basis.

Pressures in the clamping and transfer rams are independently controlled, and can be adjusted to the capacity of the presses. Both models are equipped with preform pre-heaters and automatic feeders. The latter incorporates a vibratory bowl to feed the preforms into the preheater and a conveyor to carry heated preforms into the mold. Special safety provisions include automatic detection of short shots or overcharging, and automatic detection of incompletely closed molds. Specifications of model 741 follow. The 50-ton press is identical to the 75-ton except for pressures.

	75-ton	150-ton
Clamp capacity, tons	75	150
Clamp stroke, inches	12	14
Distance between platens, open, in.	28	32
Closed	16	18
Platen area, L-R x F-B, in.	15 x 13	24 x 20
Clamp ram speed, in./min., closing	300	400
Intermediate	140	72
Pressing	0–27	0–22
Opening	300	400
Ejection stroke, in., top	2⅛	3
Bottom	3⅞	4⅛
Ejection pressure, tons, top	3	5
Bottom	5	12
Bottom transfer capacity, tons	19	30
Bottom transfer stroke, in.	8	10
Bottom transfer speeds, in./min., advance	450	360
Pressing	0–100	100
Return	450	300
Motor, hp	7½	15
Overall height, in.	95	129
Height, floor to platen, in.	35	39¾

Specifications of Model 743:

Clamp capacity, tons	300
Clamp stroke, in.	12
Mold area, L-R x F-B, in.	23⅛ x 16
Combing area, L-R x F-B, in.	19 x 16
Distance between tie rods, L-R x F-B, in.	24 x 10
Tie rod diameter, in.	4½
Distance between platens, in.	26 x 34
Ejection stroke, in.	4½
Ejection pressure tons	15
Bottom transfer capacity, tons	70
Bottom transfer stroke, in.	12
Bottom transfer speeds, in./min.	
Approach	150
Pressing	0–65
Return	150
Overall height, feet	12
Floor space, L-R x F-B, in.	55 x 138¼

Stokes Model 741 transfer press.

Readers' Service Item 23

Temperature Control Unit

A temperature control unit designed for cycling process work is claimed, by Application Engineering Corp., to provide accurate temperature control from 40 to 500° F. Rapid cycling from cold temperatures to extremely hot temperatures may be manual, or automatically controlled by machine operation or timers. The Multi-Tem two-temperature cycling unit is rec-

ommended for use in such processes as injection and compression molding.

Multi-Tem incorporates two pumps, a refrigeration unit, electrical heaters, thermostats, and electrical controls. Two oil tanks, one cold and the other hot, permit rapid cycling. As oil is pumped from tank to tank, immersion heaters add heat as required. Cold oil, maintained in a closed reservoir, can be released by valving in order to lower temperatures.

The refrigeration unit and heating elements are engineered for each application.

Readers' Service Item 24

Custom Hydraulic Presses

A line of hydraulic presses that may be custom-engineered for all types of compression molding, transfer molding, or laminating has been announced by Atlas Hydraulics Division, Delaware Valley Manufacturing Co., Inc. The line was developed for exceptional laboratory conditions under which pressure, temperature, and work results must be consistently reproduced.

A newly designed, deflection-free, slab-side frame and truly parallel platen movement allow laminating or molding tolerances to be held to ±0.001 inch. Built from standard component parts, each press is designed and engineered to individual requirements.

Electric or steam platens can be equipped with special controllers to maintain precise temperatures in any desired range up to 1,000° F. A self-contained pumping unit automatically maintains any preset hydraulic pressure during entire cure cycle.

Readers' Service Item 25

Embossing Rolls

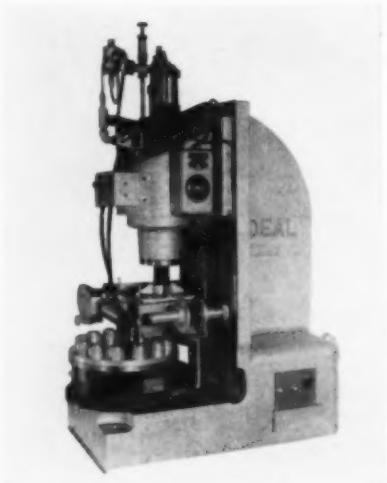
Greater operating economy is one of the features Stowe-Woodward, Inc., attributes to its Sealskin rolls for embossing plastics. Sealskin is recommended for deep or shallow embossing of supported film and unsupported film over 0.008 inch thick. It is claimed to have excellent wear resistance.

The material will withstand temperatures up to 375° F., and satisfactory results have been reported at pressures up to 400 pounds per lineal inch. While a thickness of ¾ inch is recommened for most embossing operations, ½ to 1¼ inch rolls may be specified. Sealskin resists all plasticizers used in the embossing industry today, and will not scuff or crumble under normal conditions.

Readers' Service Item 26

Hot Stamping Press

Ideal Stencil Machine Co. has developed a hot stamping press which uses foil tape to print any color. The pneumatically controlled (hydraulic control is optional) unit features electronic dwell control, precision thermostatic control, adjustable automatic foil feed, positive stroke adjustment, and pressures up to 4,800 pounds. Model A hot stamping head is available as a separate item for custom installations, and can be used on any standard punch press.



Ideal hot stamping press.

Readers' Service Item 27

3-Ounce Injection Press

Van Dorn Iron Works Co. is manufacturing a four tie bar three-ounce automatic injection press featuring high plasticizing capacity, high clamping pressure, and high speed operation. Model H-300 can be adjusted for semi-automatic or manual operations. Accessible hydraulic valves are mounted on the manifold. Speed of injection plunger and platens is adjustable.

Included in standard equipment is a 220 or 440 volt, 3 phase, 60 cycle, 15 hp. motor; 2 zone pyrometer heat control, safety gate; oil filter, plunger advance; and one shot lubrication system. Optional equipment consists of low pressure closing; weighfeeder; extended nylon nozzle (½ to ¾ inch radius); and a variety of plunger sizes for increased pressure or capacity.

Ounces per shot, styrene	3
Cubic inches molded per shot	4.85
Maximum casting area, 20,000 psi., sq. in.	50
Injection plunger diameter, in.	1⅜
Injection plunger stroke, in.	7⅛
Maximum psi. on material	20,000
Speed of injection plunger at full pressure, in./min.	215
Hopper capacity, lbs.	45
Injection cylinder diameter, in.	6
Mold clamping pressure, 8 in. stroke, tons	100
Platen travel speed, in./sec.	0–12
Mold clamping stroke, in.	4–8
Optional, in.	4–12
Mold thickness, 8 in. stroke, in.	4–12
Optional 12 in. stroke, in.	6–14
Maximum mold size, in.	12 by 18
Platen size, in.	18¼ by 16¾
Space between tie bars, in.	12⅛ by 10⅛
Diameter of tie bars, in.	2⅜
Maximum dry cycles per hr.	1100
Machine dimensions, L x W x H	11'2" x 3'2" x 6'1"
Oil reservoir capacity, gals.	60
Combined pump capacity, gals/min.	26

Readers' Service Item 28

2-Ounce Injection Machine

Among the features of Leominster Tool & Die Co.'s E-Z H injection molding machine is a dual-action hydraulic platen which synchronizes the molding cycles, permitting the injection ram to remain stationary. It is designed to mold thin pieces or deep draws up to five inches. Dimensions of this horizontal type machine are 81 by 25 by 56 inches.

Operational controls are mounted on a single panel. Specifications of this two-ounce machine are:

Casting area, sq. in.	35
Injection plunger stroke, in.	3⅛
Pressure on material, psi.	20,000
Plasticizing capacity, lbs./hr.	30–40
Cycles/hour	600–2500
Mold size, in., max.	7⅜–10⅞
Space between platens, in.	21
Mold height, in.	6–12
Locking force, tons	50
Clamping stroke, in.	0–9⅛
Clamp tie bars or rods, diameter, in.	1⅛
Space between, in.	6⅜–7⅜
Hopper capacity, lbs.	40
Cylinder heating capacity, kw.	2.6
Motor hp.	7½
Oil tank or reservoir capacity, gals.	25

Readers' Service Item 29

Fiberglass-Reinforced Fans

From Industrial Plastic Fabricators, Inc., has come a line of fiberglass fans which are claimed to handle most acid and alkali fumes over a wide range of temperature and concentration levels. The housing, wheel, spinner cap, and shaft-sealing elements of these fans are fabricated of a corrosion- and temperature-resistant polyester reinforced with fiberglass. Hardware is stainless steel.

Available in diameters ranging from 18 to 48 inches, the fans will handle 1,700 to 31,000 cfm.

Readers' Service Item 30

RCI POLYLITE Plastic Concrete Forms Cut Building Costs!

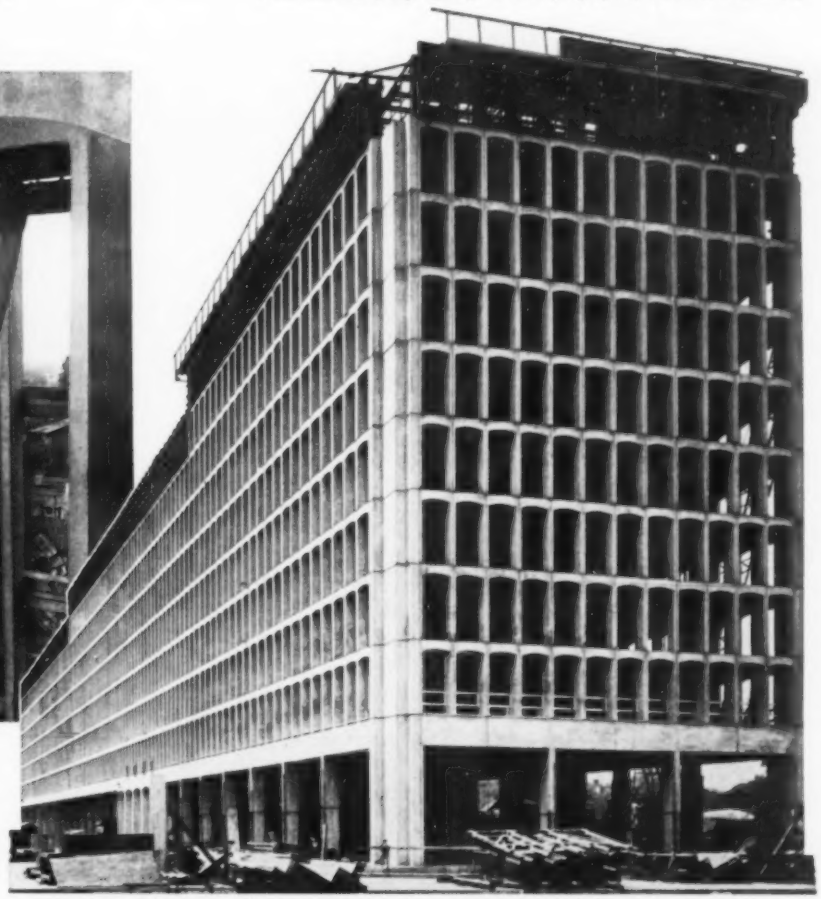
• "Reinforced plastic concrete forms made with RCI's POLYLITE polyester resin were responsible for cutting form costs by one-third in this Webb and Knapp apartment project," states Myron Austin, design engineer for Engineered Concrete Form Corporation, Chicago.

Al Schreck, carpenter superintendent for James McHugh Construction Co., Chicago, found these important advantages in reinforced plastic forms:

- They can be adapted to virtually any shape.
- They have greater strength to withstand the impact stresses of cement pours; flexural strength is about 30,000 psi.
- Light in weight, about half that of a lumber form, they can be handled and erected more economically.
- Highly resistant to abrasion, they can be used over and over again.
- Low expansion/contraction properties of reinforced plastic forms, when exposed to heat and cold, provide a high degree of dimensional accuracy in the cured concrete.
- The smooth plastic surface of the forms provide the trowelled-like finish of a skilled concrete artisan, without extra cost.

This is only one example of how plastics are improving on old techniques. If you have an application which might be simplified or improved by the use of reinforced polyester, it will pay you to call on RCI.

Part of the Webb and Knapp apartment project in Chicago which contains 4,500 arched windows poured in POLYLITE plastic forms; and close-up of one of the POLYLITE forms. With proper handling, forms can be used 50 to 100 times.



Webb and Knapp, Developer — I. M. Pei, Architects — James McHugh Construction Company, Concrete Subcontractor — Engineered Concrete Form Corporation, Form Manufacturer

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Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate • Sulfuric Acid • Methanol

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N.Y.

Plastics Applications

For more information check Readers' Service Card (p. 81)

Foamatic lounge pad.

Adjustable Outdoor Cushion

Foamatic lounge pads, equipped with a small valve to permit individual adjustment of buoyancy, have been placed on the market by Holiday Line, Inc. Made with heat-sealed Velon vinyl sheeting, a product of Firestone Plastics Co., the pads are affected neither by weather nor water immersion. They may be used as rafts in the water, as well as chair cushions.

Readers' Service Item 41

Prefabricated RP Canopy

Glass-reinforced polyester is the sole material making up a novel, 20-foot high canopy for outdoor commercial use. Tru-Scale Division, Wasco Chemical Co., which is marketing the structures, developed them in conjunction with Monsanto Chemical Co. Two have already been installed at a Baton Rouge, La., service station where, side by side, they span the driveway and pumps. At night, concealed baselights make the eye-catching structures glow.

The canopy is a 30 by 30 foot modular unit consisting of hollow, reinforced polyester beams which support flexible sheeting of the same material. The beams are made from Pittsburgh Plate Glass Co.'s Selectron 5119 polyester resin. Panels are made with #1026-Z resin supplied by Interchemical Corp. Beams are hand molded in three sections which are joined together at the job site. The 2 by 42 foot strips of sheeting are shipped rolled up and boxed. Three workers should be able to assemble the canopy in less than five days.

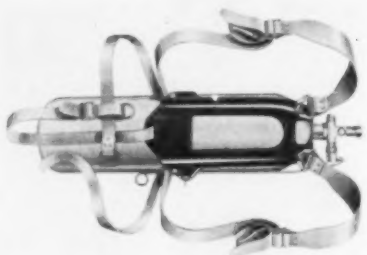
In assembly, canopy ribs are bolted to steel girder footings. Though the canopy itself is 20 feet high, base platforms can be altered to provide greater clearance. Tests of the structure's sturdiness indicated that it will withstand winds up to 80 mph.

Polyester canopies.

Readers' Service Item 42

Divers' Air Tank Holder

A single unit, plastic Aqua-Lung Bac-Pac, impervious to temperature and weather deterioration, has been developed by U. S. Divers Co. and Peerless Plastics Co. Injection molded of black Cycolac plastic in a single shot, the Bac-Pac is designed to hold the air tank steady and snug to the back of the diver. It is reported to provide eye appeal, strength, and fast tank change convenience.



Aqua-Lung Bac-Pac.

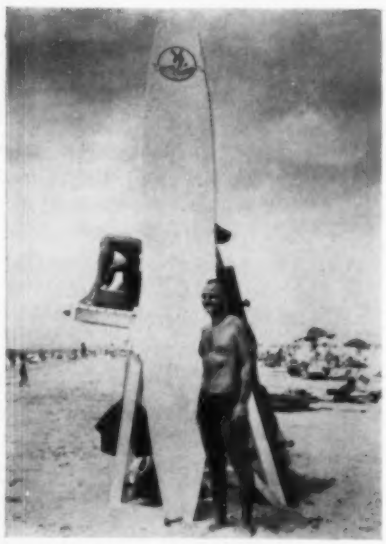
Readers' Service Item 43

Foam Surfboards

Foamed plastic surfboards with glass fiber-reinforced epoxy skins have been used for rescue operations on several Long Island beaches. The lifeguard propels the board lying in a prone position; thus he can observe the troubled swimmer at all times. Weighing 40 pounds, the surfboard can be carried by one man.

The tough epoxy skin protects the board from damage by sun and salt water, and keeps the foam interior dry and buoyant.

In normal rescue operations, the board is propelled alongside the swimmer, who is then pulled aboard and carried to shore for treatment. In cases of emergency, artificial respiration can be applied to the swimmer on the board at the rescue spot. The board is 13 feet long, 22 inches wide, and four inches thick—providing ample room for the lifeguard to maneuver with a prostrate person aboard.



Lightweight plastic surfboard.

The boards are manufactured by Hains-Russell Co. from Bakelite epoxy resins produced by Union Carbide Plastics Co.

Readers' Service Item 44

Ocean-Going Yacht

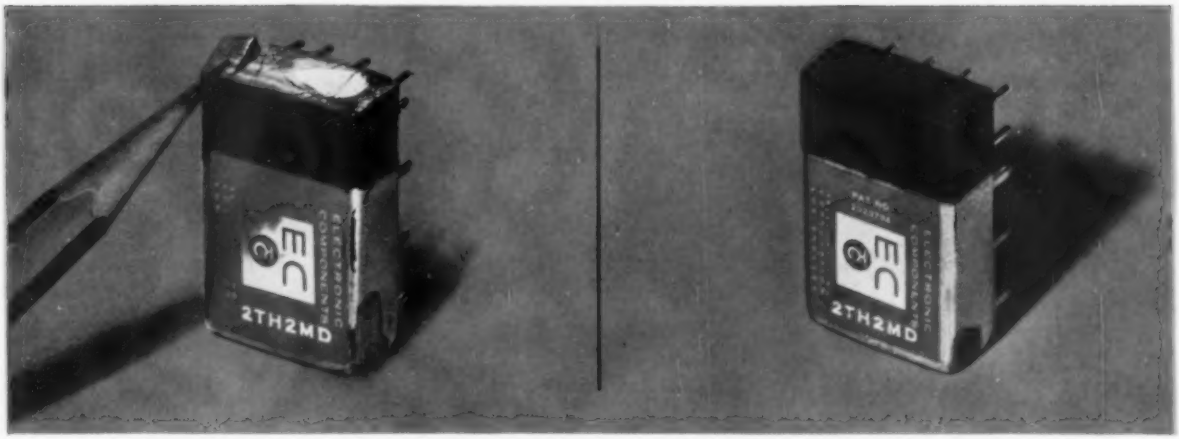
The Mercer 44, fabricated by Mercer Reinforced Plastics Corp., can be used for ocean racing or inland cruising. Designed for comfort and spaciousness as well as speed, the yacht sleeps seven on foam rubber berths. The simple sloop rig, with masthead fore triangle, is easily handled with a minimum of deck clutter. With main and working jib, she can be sailed by a couple.

Overall length is 44 feet. Other dimensions are: length water line, 30 feet; beam, 11 feet 9 inches; draft of hull, 4 feet 3 inches. Masthead is 55 feet above water line.

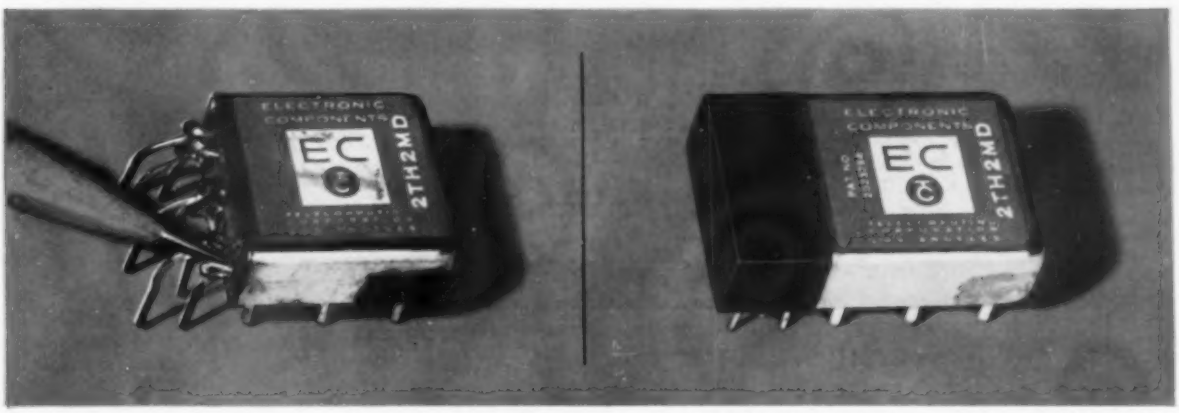
Entire hull, deck, doghouse, cockpit, and centerboard trunk are molded of fiberglass reinforced polyester. Rudder is one piece laminate with bronze stock molded in.

Readers' Service Item 45

DOW | THERMOSETTING RESINS



Under 180°C. heat, the ordinary epoxy resin cracked . . . but the epoxy novolac potting was unharmed!



In an epoxy stripper, the epoxy resin potting dissolved . . . but the epoxy novolac showed no significant change after two weeks' immersion!

DOW EPOXY NOVOLAC UNHARMED

by brutal heat and chemical torture tests!

Tests conducted by an electronics component manufacturer prove it! Compared on the basis of their ability to withstand extreme heat and powerful chemical attack, these two miniature relays demonstrated the amazing difference between a regular high-quality epoxy resin, and Dow epoxy novolac resin (D.E.N. 438).

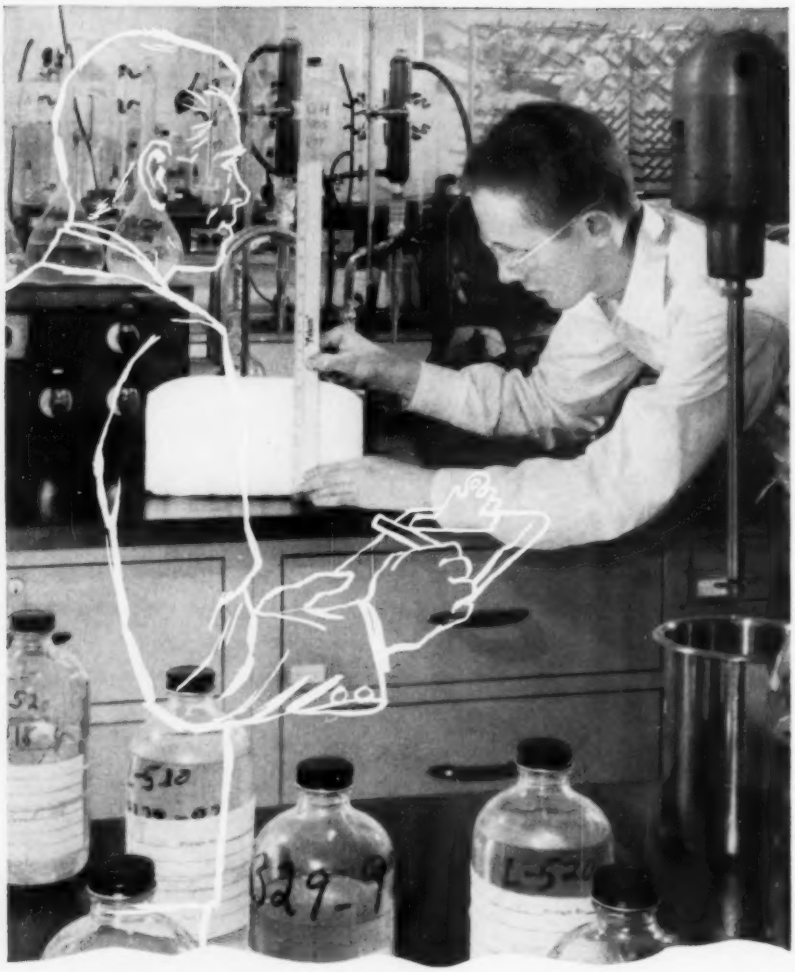
The test to determine the effects of prolonged intense heat on these two terminal pottings took place in a 180°C. oven. After five hours, the ordinary epoxy resin potting compound cracked. But after 100 hours of continuous 180°C. heat, the Dow epoxy novolac was unharmed!

A chemical resistance test compared the ability of each potting compound to withstand the action of high-powered stripping solvents similar to solvents used in cleaning electronics equipment. The ordinary epoxy resin formulation was completely dissolved after only 48 hours in the stripper. But the Dow epoxy novolac potting showed no significant change, even after two weeks' immersion!

These results prove once again that in potting, molding, encapsulating and laminating, or in any application where performance is critical, Dow epoxy novolac resins can provide the extra measure of physical and chemical stability necessary for success.

New applications for the complete Dow family of thermosetting polymers are being uncovered every day. If you have a problem that could benefit from their hardness, toughness, dimensional stability, and chemical resistance, call your nearest Dow sales office. Or write: THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Merchandising Department 1965DT7.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN



HOW THE SILICONES MAN KNOWS...

YOUR ONE-SHOT FOAM SURFACTANT IS ALWAYS UNIFORM

Every production batch of UNION CARBIDE L-520 Silicone Surfactant for one-shot polyether foams is thoroughly laboratory tested. This way, your Silicones Man can be sure it is *always uniform in the properties important for foam production.*

Tests are made on a standard one-shot foam formulation. The L-520 must meet minimum requirements for foam rise, settling at the height of the rise, foam uniformity, and freedom from splits.

True, a bench test cannot duplicate the varying production conditions encountered in plants all over the country. But it does assure you of constant uniformity in the significant surfactant properties. It has done much to help bring about widespread acceptance of the one-shot process where once there was hesitation.

For complete data, write Dept. GN-4002, Silicones Division, Union Carbide Corporation, 30 East 42nd St., New York 17, N.Y. *(In Canada:* Union Carbide Canada Limited, Toronto 7.)

UNION CARBIDE SILICONES

Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils and Emulsions

The term "Union Carbide" is a registered trade mark of UCC.

Perforated Sheet

Dorak Products Corp. is selling PVC and polypropylene perforated sheet. Called Filter-Mesh, the sheeting is recommended for fabrication of strainers, filters, or other cleaning devices providing protection for instrumentation or process equipment.

The PVC sheet is suited for contact with oxidizing chemicals at temperatures up to 168° F., while the polypropylene offers good general chemical resistance with exceptional properties in solvent service in temperatures up to 250° F. It may also serve as electrical or thermal insulation, and can be fabricated into components by solvent cementing or heat sealing. Filter-Mesh is supplied in rolls up to 100 feet long in 40, 34, 26, 18, 14, 10, 6, and 5 mesh perforated sizes.

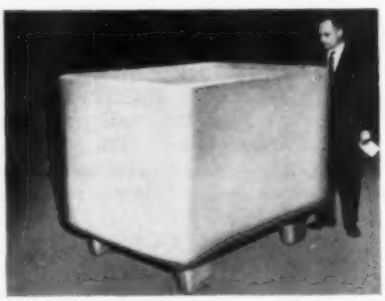
Readers' Service Item 46

Insulated Shipping Container

The Hitch-Hiker, a four-legged box made of polyurethane foam and Fiberglas sandwich, reportedly cuts costs and product losses for handlers of chilled or frozen items. Manufactured by Space Structures, Inc., the unit permits shipping of such items as dry ice and frozen foods in unrefrigerated trucks. The box is especially desirable for shipment of small quantities to out of the way places.

Weighing only about a third as much as many steel boxes of comparable capacity, the unit needs little maintenance and no painting. According to tests with dry ice shipping, product loss through evaporation was less than half of that occurring with standard boxes.

Legs of the containers can be from 4½ to 9½ inches, while capacities range from 64 cubic feet to trailer size. On a container measuring 61 by 41 by 38 inches inside (67¼ by 47¼ by 42½ inches outside), foam thickness is three inches on the sides and four inches on the bottom. Fiberglas is ¼ inch thick. K factor is 0.12.



The Hitch-Hiker.

Readers' Service Item 47

RP Mooring Buoy

A mooring buoy of reinforced plastic, with color molded in, has been announced by Zenith Plastics Co. Called the Skipper Line, the buoy is intended for mooring commercial craft as well as transit private craft in marinas, yacht club basins, and small craft harbors.

For greatest impact strength, a waterproof resin reinforced with glass fibers is filled with a unicellular foam. The conical shape makes it an undesirable perch for birds.

Zenith's Skipper Line.

Readers' Service Item 48

Rigid Foam Flotation Chambers

Flotation chambers which boatsmen will not be tempted to use as storage lockers, and which won't lose buoyancy through leaks and punctures, are a major feature of two 16-foot molded plastic boats developed for rescue and patrol work by the United States Coast Guard. The boats, rated for six passengers under normal operating conditions, will support 700 pounds of dead weight when awash.

This unusual increase of capacity for emergencies is partially made possible by a bow flotation unit of rigid urethane foam. Installation is accomplished by pouring seven pounds of foam mixture behind a temporary bulkhead. After the mixture has foamed up to fill the four cubic foot area, the bulkhead is removed, leaving the urethane foam adhering to the sides of the hull. For final protection, the foam is coated with resin and lightweight glass fiber fabric.

The hull structure is of epoxy resin glass fiber fabric. The boats, which run on inboard or outboard power, are built by the United States Coast Guard yard at Curtis Bay, Md.

The foaming composition used for the flotation chambers is Pittsburgh Plate Glass Co.'s Selectrofoam. E. I. du Pont de Nemours & Co. manufactures Hylene organic isocyanates, a basic raw material, and Freon blowing agent.

Readers' Service Item 49

Vinyl-On-Cork Wall Covering

Cork-Tex vinyl-on-cork wall covering, developed by Bond Crown and Cork Division, Continental Can Co., is recommended as a display surface for offices, stores, schools, and plants. Charts, advertisements, and other literature can be pinned or tacked to the material and later removed, leaving the material superficially unblemished. The cork contracts the vinyl after piercing or slashing, concealing lacerations.

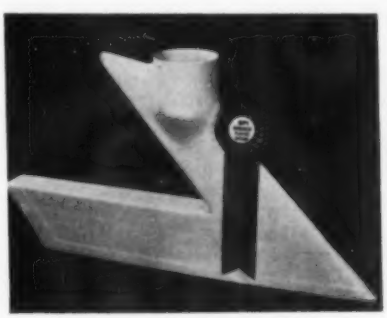
This washable material, consisting of a heavy gage vinyl bonded to ¼-inch cork, is available in rolls four feet wide and 72 feet long or in pre-framed sections up to 12 feet long. Besides the standard eight colors offered in a linen finish, more than 100 other shades and textures may be ordered. Cork-Tex is applied with a mastic adhesive.

Readers' Service Item 50

Aircraft Beacon Housing

A fin tip beacon housing molded by Cessna Aircraft Corp. for its Cessna 310 business aircraft won first prize in the aviation category of the SPI's Reinforced Plastics Division design competition. The housing is bag molded from a glass cloth preimpregnated with a diallyl phthalate vacuum molding compound. Called Mobaloy-DS, the prepreg is supplied by Cordo Molding Products, Inc., and is based on Food Machinery and Chemical Corp.'s Dapon diallyl phthalate resins.

The part is vacuum bag molded on a reinforced epoxy mold and cured for two hours at 275° F. Use of the prepreg, which has a 35-39% resin content, allows accurate control of resin and, thereby, end properties. The finished part is reported to have good surface finish and excellent resistance to moisture, aging, and weather.



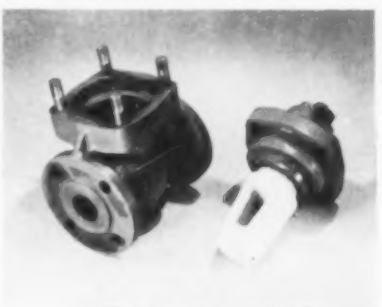
Cessna 310 fin tip beacon housing.

Readers' Service Item 51

Polyethylene Plugs

Polyethylene-coated plugs for use with saran-lined plug valves are now being sold by Saran Lined Pipe Co. According to the manufacturer, Dow Chemical Co., the linear polyethylene plugs eliminate the "freezing" that sometimes occurs when saran plugs are used with saran-lined pipe.

This "freezing" occurs when lubrication fails. When the saran surfaces get dry, it is almost impossible to move the plug for line operation. The new plugs, which remedy this situation, can be used in installations for which the polyethylene has adequate chemical resistance. They are available in eight sizes, from one to six inches.



Polyethylene-coated plug.

Readers' Service Item 52

Vinyl Laminate Wall Coverings

Royaltex laminated wall fabrics are the latest in a series of decorative materials developed by Polyplastex United, Inc. Recently introduced to interior designers, the patterns range from loosely woven jute fibers and imported linens to dramatic designs utilizing genuine butterflies, leaves, and sea heather against simple textures.

Supplied in sheets 95 inches long and 23 inches wide, Royaltex is backed by a layer of aluminum foil which serves as a moisture barrier. A layer of paper bonded to the under surface permits application by conventional paperhanging techniques. Custom patterns are available.

Four-mil Krene vinyl film, supplied by Union Carbide Plastics Co., is used for the surface.

Readers' Service Item 53

New...

PAK-MASTER for AUTOMATIC blister forming, indexing and cutting

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F.O.B. Bridgeport, Conn.

AUTO-VAC'S new **PAK-MASTER** offers you completely automatic blister forming, indexing and cutting in continuous roll-fed operation. Ideal for long runs or quick changeovers. Generous 20" x 25" forming area for blisters to 5" deep. Production rates up to 14 sq. ft. per minute. Forms acetate, butyrate, styrene, polyethylenes, vinyl and other thermoplastics, fed from standard 22" rolls.

Heating, cooling and air blow-off cycles are automatically controlled by time clocks. Mold table and clamp frames operate automatically. Indexer and cutter are controlled by microswitches for fast, accurate operation. Indexer stroke is adjustable from 13" to 26" maximum.

Accessory equipment, including cooling fans and plug attachments for deep draw items is available at extra cost.

WRITE FOR COMPLETE INFORMATION

AUTO-VAC Company
A DIVISION OF NATIONAL CLEVELAND CORPORATION
1989 State Street Ext., Bridgeport, Connecticut EDison 4-9481

Home Roofing and Siding

Shieldcoat International, Inc., is going into production of prefabricated plastic roofing and siding which will be called Shieldite. Principal advantages claimed for the material are durability, fire resistance, lighter weight, construction speed-up, lower costs, and colorful finish.

Prefabrication starts with a conventional roof decking or side paneling base. Over this is stretched fiberglass cloth for surface strength. A thin coat of self-extinguishing epoxy resin with a flame resistant plasticizer is applied with a roller, spray gun, or flow coater. Before the coating hardens, the plastic is surfaced with colored mineral granules. Flashing and panel joint seals are necessarily applied on the job, by the same process.

According to the company, the finished roofing and siding is acid, alkali, corrosion, and erosion resistant, and cannot oxidize, rot, or deteriorate.

Readers' Service Item 54

Epoxy-Glass Pressure Fittings

Ed Conley Plastic Corp. is selling over 430 different patented epoxy-glass fittings in sizes from one through six inches. The fittings will handle working pressures up to 1,000 psi. They are especially recommended for use with corrosive liquids.

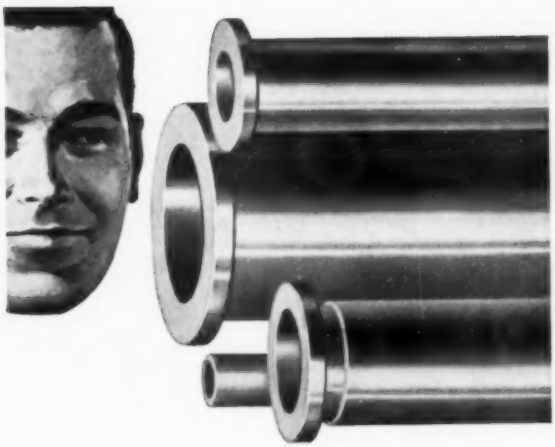
Readers' Service Item 55

Corrosion-Proof Angles

Reinforced plastic Glasrin angles, made of four different materials for specific functions, are claimed by Plastic Age Sales, Inc., to have exceptionally high strength to weight ratios. For general use, angles of polyester resin and fiberglass mat may be used. Polyester resin and fiberglass cloth supply greater strength. If heat resistance is required, angles of phenolic and fiberglass cloth offer the best solution. A special epoxy resin and fiberglass cloth laminate is the strongest.

Maximum tensile strength of the angles is 58,000 psi.; compression strength, 90,000 psi.; flexural strength, 100,000 psi. Specific volume is 118.7 pounds per cubic foot maximum. The angles are available in standard lengths of 14 feet, 6 inches, in 73 leg sizes, and in thicknesses ranging from ½ by ½ by 0.040 inch to 6½ by 6½ by 0.500 inches. Molded in color for identification, the angles may be machined and drilled. Odd leg sizes and shapes can be supplied.

Readers' Service Item 56



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New Literature

For more information check Readers' Service Card (p. 81)

"Export Products List." Hooker Chemical Corp. 16 pages. This folder alphabetically enumerates names, chemical structure, general descriptions, physical data, uses, and shipping containers of Hooker chemicals available for export.

Readers' Service Item 61

"Cast Film." U. S. Industrial Chemicals Co. 12 pages. The pamphlet describes film casting equipment and discusses cast film properies. Effects of process variables and changes in density and melt index on film properties comprise the major portion of the text.

Readers' Service Item 62

"Havelex Custom Molded Inorganic Insulation." Taunton division, Haveg Industries, Inc. 8 pages. Properties of the material, formerly G.E. Mycalex, are described for design engineers in the electronic, electrical, missile, and allied industries.

Readers' Service Item 63

"Room Temperature Curing System for Atlac 382." Atlas Powder Co. 5 pages. The bulletin outlines a two-component, room-temperature curing system for this bisphenol polyester resin. The system is applicable to gel coating, two-pot spray application, and hand lay-up lamination.

Readers' Service Item 64

"Microthene — Polyethylene in Powder Form." PTD 14-360. U. S. Industrial Chemicals Co. 8 pages. The bulletin describes applications, how to use the material, and describes the grades available. Four pages are devoted to coating—surface preparation, dispersion coating, coating with pastes, and powder coating.

Readers' Service Item 65

"Vented Reverse Flow Heating Cylinders To Fit All Injection Machines." Injection Molders Supply Co. 6 pages. Diagrams, photos, and descriptive material on how the cylinders work. The advantages of degassing cylinders with styrene, vinyls, cellulosics, and acrylics are described.

Readers' Service Item 66

"Harshaw Vinyl Stabilizer Service." Bulletin No. 60-1. Harshaw Chemical Co. 18 pages. Properties for all the firm's stabilizers are listed, along with special requirements and special effects.

Readers' Service Item 67

"Lexan Polycarbonate Resin." CDC-375. Chemical Materials Department, General Electric Co. 4 pages. According to the folder, 35 manufacturers of electrical products are using polycarbonate resin for such products as coil forms, connecters, terminals, and current-carrying support parts. Lexan is distinguished by high impact strength, heat resistance, good electrical properties, dimensional stability, and self-extinguishability.

Readers' Service Item 68

"Laminated Plastics Selection Guide." Taylor Fibre Co. 12 pages. A manual including information on specifying and ordering high pressure laminated plastics is accompanied by a reference chart of characteristics for 21 commonly used laminate grades. Explanations of minimum-maximum property values and specifications and tables of tolerances are featured.

Readers' Service Item 69

"Conversion Chart." Naugatuck Chemical Division, U. S. Rubber Co. 2 pages. The chart lists specific gravities of thermoplastics and metals with conversion figures in ounces and grams per cubic inch. Volume formulae for common shapes are shown on the bottom of the card.

Readers' Service Item 70

"Technical Data Brochure." Panelyte Division, St. Regis Paper Co. 20 pages. Aimed at the architect, this brochure presents information on the application of high pressure decorative laminates. It covers both design and specifications.

Readers' Service Item 71

"Bonding of Teflon-Insulated Wire." Technical Bulletin C-25A. Hitemp Wires, Inc. 4 pages. The bulletin outlines developments in adhesion promotion of Teflon-insulated wire and cable to insure bondability with various potting compounds. Techniques for treating Teflon are explained.

Readers' Service Item 72

"How to Determine Square Feet of Surface Required for Heat-Up." Technical Data Sheet 78. Dean Products, Inc. 1 page. The chart aids calculation of square feet of Panelcoil heating surface required to heat water to a given temperature in a given time. Factors required are gallons to be heated; desired operating temperature; minimum time; "U" heat transfer value; operating steam pressure.

Readers' Service Item 73

"Blow Molding of Hollow Objects with Grex High Density Polyethylene." Technical Service Bulletin 105. Polymer Chemicals Division, W. R. Grace & Co. 12 pages. The bulletin discusses advantages of blow molding; principles and techniques; decorating molded articles; raw materials; and applications.

Readers' Service Item 74

"Polymer Products Directory." Borden Chemical Co. 11 pages. The catalog lists technical data, properties, and end uses of such polymers as polyvinyl acetate copolymer and homopolymer emulsions, solutions, and bead resins; styrene-butadiene emulsions; acrylic emulsions and solutions, polystyrene emulsions; vinyl and vinylidene chloride emulsions; polyvinyl alcohol; and others.

Readers' Service Item 75

"Chemical Resistance of Grex High Density Polyethylene." Technical Service Bulletin 104. Polymer Chemical Division, W. R. Grace & Co. 12 pages. Test results on the exposure of blow molded bottles to more than 150 chemicals and household reagents is tabulated in terms of staining, embrittlement, softening, permeation, and stress cracking.

Readers' Service Item 76

"Nervastral Products." Bulletin 107A. Rubber & Plastics Compound Co., Inc. 4 pages. The bulletin outlines the company's products for construction, including Seal-pruf for flashing and waterproofing; Rigid for preformed masonry wall; P.E.T. film for moisture barrier use; pressure sensitive tape; and cement.

Readers' Service Item 77

"Plasticizers in Synthetic-Resin Adhesives." Technical Bulletin No. PL-307. Organic Chemicals Division, Monsanto Chemical Co. 28 pages. With the use of proper plasticizers, synthetic resin adhesives can be formulated for improved film formation, better tack, faster drying, flexibility, and gloss. The bulletin contains data on the properties and applications of plasticizers which impart these qualities.

Readers' Service Item 78

Book Reviews

"Mon Bateau en Plastique" ("My Plastics Boat"), Gaston Kesler. Published by Editions Amphora, 119 Avenue Parmentier, Paris (X1). Paper 9½ by 6 inches, 110 pages. Price, 1,300 francs.

How a group, say the members of a boating club, can build a simple glass-reinforced resin dinghy is described, each step being explained and illustrated. After the pros and cons of reinforced-plastics hulls for boats and the facing of wood boats with plastics have been dealt with, details are given on constructing a dinghy 2.28 by 1.11 meters, of a type actually built by the students in the reinforced-plastics division at a center for the technical training of adults, under the French Ministry of Industry. The requirements for a suitable workshop are discussed, as well as the time, tools, and raw materials needed to make the models, molds, and major components. It is emphasized that no one should attempt the job alone, and that an expert should be on hand to direct and supervise operations. (In French.)

"ASTM Standards on Plastics." ASTM Committee D-20 on Plastics. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Paper, 6 by 9 inches, 1090 pages. Price, $8.00 (Member, $6.40).

ASTM Committee D-20 has drawn up specifications, recommended test methods and practices, descriptive nomenclature, and definitions for plastics. In addition, the work includes specifications, test methods, recommended practices, and definitions applying to plastics in the electrical insulation field. The latter are under the jurisdiction of Committee D-9 on Electrical Insulating Materials.

Specifications are provided for molding compounds and base materials, and standard and molded shapes. Methods of testing are included for standard and molded shapes; mechanical, thermal, optical, electrical, and permanence properties of plastics; analytical methods; molds and molding processes; adhesives; conditioning; and miscellaneous subjects. Contents is tabulated in both numerical and topical sequence.

"Research Reports Nos. 15, 16, 17, and 18." Orville D. Lascoe. American Society of Tool Engineers Research Fund, 10700 Puritan Ave., Detroit 38, Mich. Paper. Price, $1.50 per report ($.75 for members).

These four reports, based on research conducted by the department of industrial engineering of Purdue University under sponsorship of the ASTE Research Fund, are additions to a series concerned with plastics for tooling.

Report No. 15, part II of the "Plastic Tooling Bibliography, covers technical papers, books, and articles about plastic tooling. Supplementing Research Report No. 5, it includes a textbook list and approximately 200 article abstracts.

Measurement of linear shrinkage, volumetric shrinkage, and impact resistance are discussed in the other three booklets. Each explains the equipment, materials, and procedure of a single test method, and evaluates the results. "Linear Shrinkage Test Methods" (Report No. 16) demonstrates that when using a refined technique as described in the volume, consistent results can be produced. Readings can be reproduced to within 0.0001 inch per inch of length on two specimens poured simultaneously from the same mix, and within 0.0002 inch per inch on six specimens poured from different mixes at different times.

Report No. 16 and Report No. 17, "Volumetric Shrinkage Test Methods," indicate that, since there is a lesser degree of correlation between pairs of castings than within a pair, the greatest error results from variations other than those in casting and measuring the material. No. 17 is concerned with inconsistencies in previous tests as well as changes and refinements in the molds used for measuring volumetric shrinkage.

"Impact Test Methods" (Report No. 18) discusses the problem of impulsive forces, the impact on plastic tools, the behavior of plastic tools during conditions of impact, and the design of a proposed impact testing machine.

"Russian for the Scientist." John and Ludmilla Turkevich. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Cloth, 6¼ by 9¼ inches, 255 pages. Price, $5.95.

This book is designed for the English-speaking scientist who wishes to extract particular information from Russian scientific literature. Its aim, therefore, is to teach correct pronunciation, a recognition knowledge of cognates, and basic grammar.

Each lesson introduces not only a new grammatical topic, but a vocabulary list. The authors begin vocabulary study with chemical terms. About midway, unsimplified scientific texts on aeronautical engineering, biology, chemistry, and physics are introduced. Literature from other sciences is omitted because of space.

While most essentials of Russian are included, features of the language that play no great part in scientific usage have been omitted.

"Heatsealing and High-Frequency Welding of Plastics." Hans Peter Zade. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. Cloth, 5½ by 8¾ inches, 211 pages. Price $5.75.

During the years since the publication of the author's first book on plastics welding in 1946, significant changes have been made in approaches to welding problems and techniques for solving them. It is the intention of this book to survey technical developments in heatsealing and high-frequency welding of thermoplastic materials, and to summarize current information about the two fabricating processes and their industrial applications. Both theory and practice are considered.

Since both of these processes are used primarily with sheet, foil, or film, the discussion of materials tabulates the physical, thermal, and electrical properties of films as well as raw materials. Among weldable resins are cellulosics, polyamides, vinyls, polyolefins, and fluorocarbons.

Equipment for heatsealing begins with simple, hand tools and proceeds through jaw sealers, impulse sealers, continuous sealers, molten bead and hot filament sealers, to radiant heatsealing and fully automatic bag-making machines. For setting up a high-frequency welding plant, basic components such as generators, oscillators, and electrodes must be considered. Processing machinery runs, like heatsealing machinery, from hand-operated welders to complex power-operated press welders. Finally, there is the special packaging plant specializing in heatsealing and high-frequency welding with an assortment of equipment.

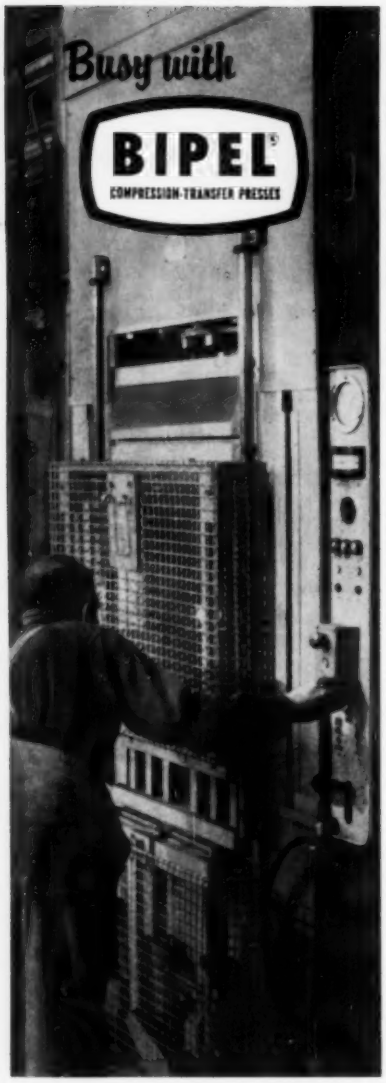
Packaging of goods probably is the largest application of heatsealing and high-frequency welding. An attractive thermoplastic package increases sales appeal. However, both processes are used in fabricating industrial, scientific, medical, and consumer goods as well.

A 40-page index of international patents traces the development of welding methods for plastics over the past 18 years. A second index, listing the trade names of thermoplastics, provides an aid for selection of suitable materials.

"A High-Rate Tension Tester." Stephen Strella and others, Picatinny Arsenal, U. S. Army Ordnance Corps. PB 151151, OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 14 pages. Price, $.50.

A tension tester with a very high loading rate was developed for determining high rate tensile behavior of viscoelastic and allied materials. Fracturing in from five to 40 milliseconds is achieved by suddenly releasing compressed gas into a cylindrical chamber to drive a piston attached to the specimen. The gas escapes through longitudinal slots in the chamber walls, rapidly releasing the specimen from tensile strain.

Because of the loading system, both sample and grips are exposed. Thus samples can be quickly changed, and different sample shapes and types of grips can be used. The fast-opening valve permits testing samples in less time than is required for the same number in standard static tests.



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Patent Digest

Materials

Polyethylene. No. 2,904,480. W. C. Rainer, E. M. Redding, and J. J. Hitov, Baltimore, Md., and A. W. Sloan and W. D. Stewart, Alexandria, Va. (to W. R. Grace & Co., Cambridge, Mass.).

Aldehyde Resin-Epoxy Resin-Organic Polyisocyanate Prepolymer, Method of Making Foam Therefrom and Product. No. 2,906,717. K. Sekmakas, Chicago, Ill. (to Minnesota Mining & Manufacturing Co., St. Paul, Minn.).

Fast Curing Organosiloxane Resins. No. 2,906,734. H. A. Clark, Midland, Mich. (to Dow Corning Corp., Midland, Mich.).

Polytrifluorochloroethylene and Cobaltic Oxide or Cobaltic Sulfide. No. 2,906,730. F. J. Honn, Westfield, N. J. (to Minnesota Mining and Manufacturing Co., St. Paul, Minn.).

Vinyl Aromatic Polymers Stabilized with Salicyloylmorpholines. No. 2,906,728. W. K. Schweitzer, Jr., Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Epoxy Resin Compositions of Improved Heat Hardening Characteristics and the Process of Their Production. No. 2,906,723. J. Reese, Wiesbaden-Biebrich, Germany (to Chemische Werke Albert, Wiesbaden-Biebrich, Germany).

Composition Comprising Epoxide Resin and Trifluorochloroolefin Copolymer and Process of Crosslinking Same. No. 2,904,528. F. J. Honn, Westfield, N. J. (to Minnesota Mining and Manufacturing Co., St. Paul, Minn.).

Apparatus for Moulding Plastic Materials. No. 2,903,747. R. Wucher, St. Ouen, France.

Vinylidene Resin Compositions Plasticized with Dibenzyl Esters of Dicarboxylic Acids and Process of Extruding. No. 2,905,651. R. J. Reid, C. Fulton, W. M. Smith, Jr., Cuyahoga Falls, and B. H. Werner, Akron, O. (to Firestone Tire & Rubber Co., Akron, O.).

Composition Comprising a Vinylidene Chloride Polymer and Mixtures of Alkali Metal Salts of Oxy Acids. No. 2,905,648. E. M. Haas, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Oil- Modified Glycerin- Glycol- Terephthalate Resin. No. 2,905,650. M. C. Agens, Schenectady, N. Y. (to General Electric Co.).

Oriented Products from Graft Copolymers of Vinyl Ester on Acrylonitrile Polymer. No. 2,905,653. R. A. Hayes, Cuyahoga Falls, O. (to Firestone Tire & Rubber Co., Akron, O.).

Air Relief Valve for a Plastics Extrusion Ram. No. 2,904,830. E. A. Mulrooney, Jr., New Castle, Del. (to Continental-Diamond Fibre Corp., Newark, Del.).

Centrifugal Casting Apparatus Particularly for Plastic Tubing. No. 2,904,836. R. O. Jefferson and L. Trinkle, Huntington, Ind. (to Deluxe Coils, Inc., Wabash, Ind.).

Copolymerization of Chlorotrifluoroethylene and an Alkyl Vinyl Ether. No. 2,905,660. J. J. Robertson, Akron, O. (to Firestone Tire & Rubber Co., Akron, O.).

Apparatus for Molding Tubes. No. 2,903,746. E. Duhamel, Colmar, and A. Stephan, Grenoble, France (to Societe Nouvelle Baele-Gangloff, Villeurbanne (Rhone), France).

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.
—The Editor

Patent Digest (Cont'd.)

Light Stable Halogen-Containing Resins Containing Phosphate Ester and an Aryl Alkane Sulfonate. No. 2,885,377. W. S. Knowles, Kirkwood, Mo., and J. Dazzi, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

Irradiated Polyethylene. No. 2,906,678. E. J. Lawton, Schenectady, N. Y. (to General Electric Co.)

Force Plug for Molded Articles. No. 2,904,837. L. T. Crabbe, Hinsdale, Ill (to Phoenix Metal Cap Co., Inc., Chicago, Ill.).

Injection Molding Die and Nozzle Combination for Forming Sprue-Free Articles. No. 2,904,839. W. K. Beckwith, Whitewater, Wis. (to Parker Pen Co., Janesville, Wis.)

Heat and Light Stable Rigid Thermoplastic Polyvinyl Halide Compositions. No. 2,902,460. G. B. Jennings, Avon, and C. E. Parks, Bay Village, O. (to B. F. Goodrich Co., New York, N. Y.).

Siloxane-Silicate Elastomer. No. 2,902,467. A. D. Chipman, Bay City, Mich. (to Dow Corning Corp., Midland, Mich.).

Equipment

Injection Molding Machines. No. 2,894,284. B. M. Allison, Maumee, and W. Schmid, Toledo, O. (to Owens-Illinois Glass Co.).

Screw for Handling Thermoplastic Resins. No. 2,896,253. E. A. J. Mol, Fort Wayne, Ind. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Filtering Liner for Barrels of Extrusion Machines. No. 2,895,167. L. Paggi, Belleville, N. J. (to Mario Maccaferri, Rye, N. Y.).

Extrusion Die Assembly with Flow-Correcting Baffle Plate. No. 2,894,625. C. S. Harris, Midland, Mich., and C. J. Huffman, Ferguson, Mo. (to Dow Chemical Co., Midland, Mich.).

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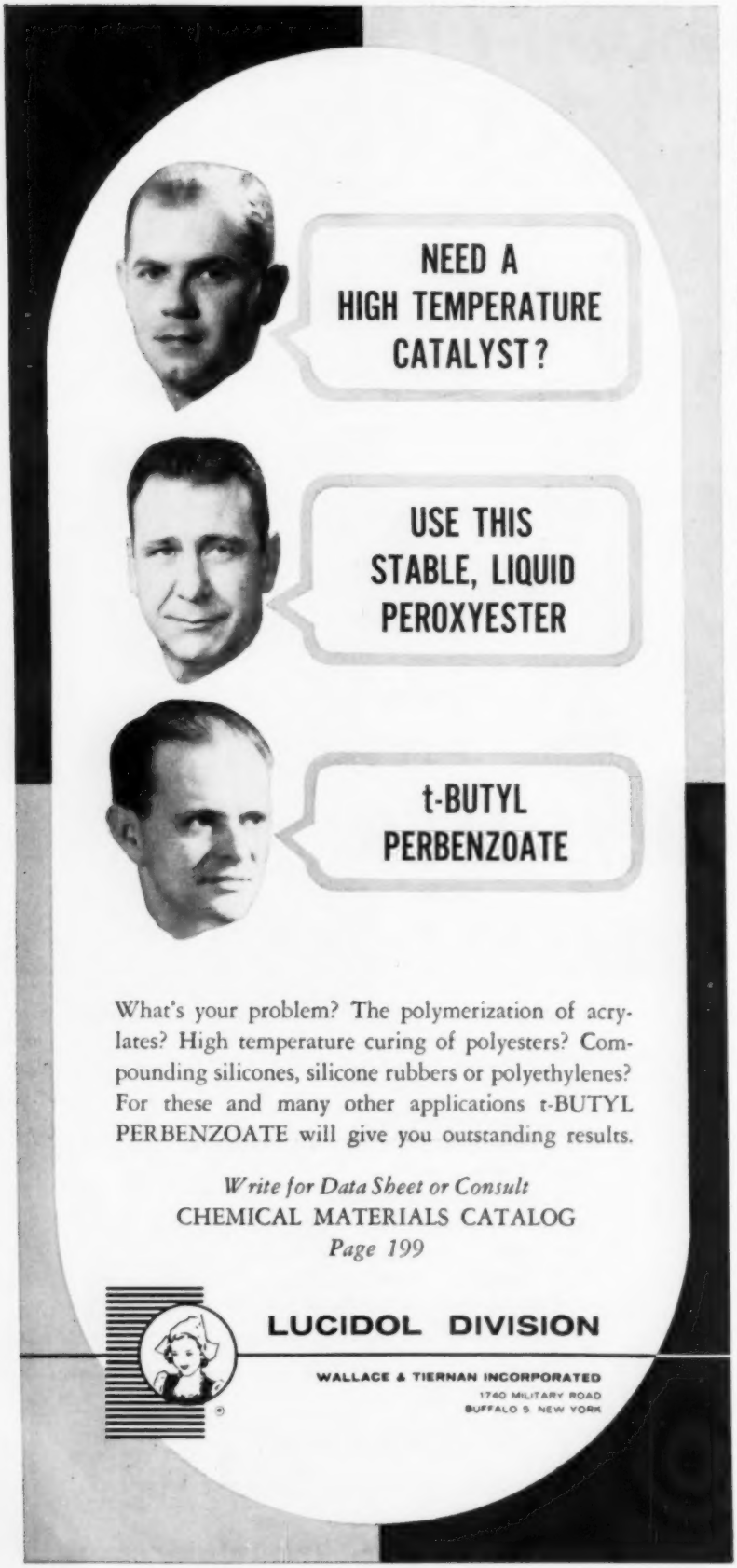
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CHEMICAL MATERIALS CATALOG
Page 199
LUCIDOL DIVISION
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Patent Digest (Cont'd.)

Apparatus for Injection Molding of Articles. No. 2,896,258. E. P. Moslo, Cleveland, O.

Molding Plastic Articles. No. 2,899,-706. R. S. Caviness, Bethesda, Md.

Control Apparatus for Extrusion Press Machinery. No. 2,897,783. E. Drexler, Leominster, Mass. (to Lombard Corp., Youngstown, O.).

Apparatus for Extruding Sheets with Striped Pattern. No. 2,897,541. C. D. Orsini, Highland Park, N. J. (to Nixon Nitration Works, Nixon, N. J.).

Multi-Part Extruder Head. No. 2,897,-543. R. D. Weston, Cuyahoga Falls, and F. K. Barnes, Akron, O. (to B. F. Goodrich Co., New York, N. Y.).

Method and Apparatus for Molding Threaded Articles. No. 2,899,705. H. S. Darlington, Jr., Media, Pa. (to A. H. Wirz, Inc., Chester, Pa.).

Dummy Block. No. 2,894,624. D. G. Leonard, Ferguson, Mo. (to Dow Chemical Co., Midland, Mich.).

Machine for Molding Plastic Materials. No. 2,896,251. O. B. Sherman, Toledo, O. (to Owens-Illinois Glass Co.).

Apparatus for Moulding Plastic Materials. No. 2,885,734. R. Wucher, St. Ouen, France.

Shaping Plastic Sheets. No. 2,885,732. R. W. Kazmaier, Maumee, and G. Perry, Toledo, O. (to Libbey-Owens-Ford Glass Co., Toledo, O.).

Process and Apparatus for the Production of porous or Homogeneous Plastic Semi-Finished Products or Finished Articles, More Especially Those Based on Polyurethanes. No. 2,885,268. K. Breer, Koln-Flittard, and E. Weinbrenner, Leverkusen-Bayerwerk, Germany (to Farben-fabriken Bayer AG., Leverkusen, Germany).

Article Abstracts

Materials

"Determination of Shrinkage, Post Shrinkage and Swelling of Molding Materials," W. Woebcken, KUNSTSTOFFE, 49, 8, 373 (Aug. 1959).

Investigations were carried out to determine the extent to which fillers and their orientation are responsible for shrinkage of phenolic and melamine-based moldings when heated, and for swelling when exposed to moisture. (In German.)

"Theory of Gas Permeability of Plastics Foils A Critical Survey of the Literature," N. Buchner, KUNSTSTOFFE, 49, 8, 401 (Aug. 1959).

Comparison of a large number of published measurements on gas permeability of plastics foils with the theories offered to explain it, show that the process takes place according to a single law—the gas passes through the material as a result of "solution diffusion." It does not pass through micropores in a gaseous or adsorbed state and plastics sheet and film of the usual thicknesses may be considered to be non-porous. (In German.)

"Creep in Rigid Thermoplastics," D. R. Reid, BRIT. PLASTICS, 32, 10, 460 (Oct. 1959). Results of a study of creep in rigid PVC and rubber-modified polystyrene are described and compared with published data on other materials. It is shown that at least four polymers, including plasticized cellulose nitrate and cellulose trinitrate, besides the two above mentioned obey the Andrade equation for tensile creep. It also is brought out that no other empirical equation seems to have been propounded for thermoplastics Some of the difficulties of applying creep data are mentioned, particularly the problems in extrapolating short-term tests to give long-term results.

"Viscosity Measurements of Thermoplastics," W. Holzmuller and I. Lorenz, PLASTE U. KAUTSCHUK, 6, 5, 227 (May 1959).

A cone-cylinder viscosimeter was specially developed for continuous measurement of the relation of flow processes to temperature and shearing stress. When viscosity of a number of thermoplastics was measured in the range of 106-109 poises, substantial reduction in viscosity was observed as shear stress increased. The temperature relationship could be represented by an exponential function. (In German.)

Equipment

"Galvanoplastically Produced Hard Nickel Molds for Plastics Processing," P. Spiro, KUNSTSTOFFE, 50, 3, 191 (March 1960).

Reasons are given for choosing nickel molds.

"Two-Row Injection Molding Tools for the Production of Long, Tube-Like Moldings," H. Gastrow, KUNSTSTOFFE, 50,

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E. St. Louis, Illinois • Easton, Pennsylvania • Emeryville, California

4, 259 (April 1960).

A tool for ejecting these parts in the direction of the machine's opening action.

"Heat Treatment of Compression and Injection Molds for Plastics," W. Haufe, PLASTVERARBEITER, 10, 3, 97; 10, 5, 177; 10, 6, 209; 10, 9, 345 (March, May, June & Sept. 1959).

The causes of the stresses that arise during the manufacture and hardening of steel molds that result in faulty molds, are examined. It is shown how these stresses can be reduced by heat treatment, and proved methods applicable to the various steels used in manufacturing molds for plastics are indicated and illustrated by examples. (In German.)

"Improving Screw Extruder Efficiency by Increasing Peripheral Velocity from 0.5 to 7/ms, While Taking Into Consideration Necessary Quality Limits," E. Beck, KUNSTSTOFFE, 49, 7, 315 (July 1959).

Earlier investigations on increasing speed of conventionally-designed screw extruders for autogenous operation are discussed and the reasons given for speed limitations. Test results obtained with partial batching in a high-speed machine make clear the measures that should be taken to increase speed limits ten-fold. The economic and constructional advantages of high-speed screw extruders are explained. Finally, the improvements achieved in these machines and their effects on output efficiency are reported. (In German.)

Applications

"Protection for Conveyor Belt Edges," R. Pfab, GUMMI UND ASBEST, 12, 6, 380 (June 1959).

Various means have been proposed for protecting the edges of rubber or plastics conveyor belts, including the use of plastics materials. Methods employing polyurethane, acrylics, and PVC for the purpose briefly are described. (In German.)

"Polystyrene Closures—Properties and Design," R. E. Pfister and J. W. Mighton, PRACTICAL PLASTICS, 11, 3, 15 (March 1960).

A discussion of closures based on product design, shapes, and decorative colors.

"Plastics Glove Boxes for Handling Radioactive Materials," L. W. Carter, PLASTICS (LONDON), 24, 263, 324 (Sept. 1959).

Until recently, glove boxes for handling radioactive materials were made from resin-coated steel having Perspex panels provided with ports to enable operators to view their work. The hazards of metal contamination led to search for new materials, and polyester/glass laminates are replacing steel for the boxes. The author describes the technique in glove-box work, the design of the boxes, and the various components already made of different plastics and others being tested. The latter include filters, nylon-covered internal parts of the fan chamber of a new high efficiency blower, and nylon bearings. The plastic boxes offer various advantages and are proving of great value to atomic energy research workers.

General

"PVC Sales and Prices," A. G. Wansink, PLASTICA, 12, 4, 260; 12, 5, 364 (April & May 1959).

In the latter part of 1958, producers of PVC. particularly in England and the United States, had been disturbed by the incursion of low-priced Italian and Japanese PVC. The author examines the situation, discussing production, application, and consumption figures in various countries, the development of prices and the outlook for Japanese exports. The view seems to be that uneasiness in England is justified, but exaggerated in the United States. (In Dutch.)

"Structural Design of Plastics," E. Baer, J. R. Knox, T. J. Linton, and R. E. Maier, SPE J., 16, 4, 396 (April 1960).

A general discussion of plastics properties suitable for design use.

Requests for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"Applied Plastics"
The Scientific Press, Ltd.
11 Gloucester Road
London, S.W. 7, England

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
243 Elizabeth Street, Suite 406,
Sydney, N.S.W., Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stamford St.
London, S.E.I., England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Gummi & Asbest"
A. W. Gentner-Verlag
Forsterstrasse 131, Postfach 688
Stuttgart, W. Germany

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27,
Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26,
Germany

"Kunststoff Zerater"
Kettenhofweg 111
Frankfurt A.M., Germany

"Materials in Design Engineering"
Reinhold Publishing Corp.
430 Park Ave., New York 22, N. Y.

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N. Y.

"Modern Plastics"
575 Madison Ave., New York 22, N. Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W. 7, Germany

"Plastic"
Danish Technical Press
31 Vester Farimogsgade
Copenhagen 5, Denmark

"Plastica"
Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

"Plastics"
Temple Press, Ltd.
Bowling Green Lane, London E.C.I.
England

"Plastics Age News"
Plastics Age Co., Ltd.
34 Higashi-Shimizu-machi
Minami-ku
Osaka, Japan

"Plastics Industry News"
Institute of Polymer Industry, Inc.
Mitsubishi-Maka- 6-1
Marunouchi, Chiyoda-ku
Tokyo, Japan

"Plastics World"
Cleworth Publishing Co., Inc.
1 River Road, Cos Cob, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Rudolf Zechner Verlag, G.m.b.H.
Speyer/Rhein, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Practical Plastics"
Box 4850
G.P.O. Sydney, Australia

"Progressive Plastics"
481 University Avenue
Toronto 2, Canada

"Revista de Plasticos"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
65 Prospect St., Stamford, Conn.

"Spectator"
Published by New England Chapter
Society of Plastics Engineers, Inc.
Somers, Conn.

"Transactions of the Plastics Institute"
6 Mandeville Place, London W.1.
England

"Western Plastics"
Western Business Publications
274 Brannan Street
San Francisco 7, Calif.

Directory

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160 mesh	lb.	$ .075	/$ .0875
325 mesh	lb.	.075	/ .09
Plasticizers			
Monsanto			
aroclors	lb.	.1525	/ .2025
Dibutyl phthalate	lb.	.275	/ .315
Dicyclohexyl phthalate	lb.	.46	/ .475
Diethyl and dimethyl phthalate	lb.	.265	/ .305
DIDA, DNODA, DOA	lb.	.40	/ .44
DIDP	lb.	.265	/ .305
DIOP, DOP	lb.	.26	/ .30
Dytrol	lb.	3.10	/ 3.45
HB-20	lb.	.15	/ .185
HB-40	lb.	.19	/ .23
Mod-Epox	lb.	.46	/ .47
Montars	lb.	.0525	/ .08
Santicizer 1-H	lb.	.50	/ .52
8	lb.	.43	/ .47
9	lb.	.42	/ .44
140	lb.	.325	/ .360
141	lb.	.34	/ .375
160	lb.	.26	/ .30
165, 603	lb.	.255	/ .295
213	lb.	.27	/ .31
214	lb.	.285	/ .325
216	lb.	.09	/ .13
409	lb.	.39	/ .42
602, 636	lb.	.2625	/ .2675
630	lb.	.23	/ .235
631	lb.	.242	/ .247
644	lb.	.40	/ .405
B-16	lb.	.46	/ .49
E-15	lb.	.5225	/ .5525
M-17	lb.	.435	/ .465
Santomask II	lb.	.80	
Tricresyl phosphate	lb.	.325	/ .36
Triphenyl phosphate	lb.	.415	/ .435
Triphenyl phosphite	lb.	.460	/ .470
Resins and Molding Compounds			
ABS			
Cycolac pellets, natural and black	lb.	.49	
Colors	lb.	.51	
Powder	lb.	.45	
Polyamide			
Fosta nylon BK 40F natural	lb.	1.21	/ 1.38
61A, 61ASK, 62ASK, 62BE, 64A Natural	lb.	1.04	/ 1.21
Dry blend black & white	lb.	1.07	/ 1.15
Standard colors	lb.	1.11	/ 1.23
Extruded black	lb.	1.11	/ 1.28
White	lb.	1.14	/ 1.42
Standard colors	lb.	1.18	/ 1.46

CALENDAR of COMING EVENTS

September 8-9
SPE Eastern New England Section RETEC. Vinyl Plastics and Plastics in the Shoe Industry. Statler-Hilton Hotel, Boston, Mass.

September 22
SPE Binghamton Section RETEC. Plastics in Business Machines. Sheraton Inn, Binghamton, N. Y.

September 27-29
Technical Association of the Pulp and Paper Industry. Eleventh Annual Testing Conference. Pantlind Hotel, Grand Rapids, Mich.

October 9-12
ASME Rubber and Plastics Conference. Lawrence Hotel, Erie, Pa.

October 13-14
SPI Sixteenth Annual New England Section Conference. Wentworth-by-the-Sea, Portsmouth, N. H.

October 14-23
French Packaging Institute. First International Packaging Machinery Show, Autopac 1960. Paris, France.

October 17-19
International Congress, 1960, on the Technology of Plastics Processing. Royal Institute for the Tropics, Amsterdam, Holland.

October 17-19
Technical Association of the Pulp and Paper Industry. Fifteenth Plastics-Paper Conference. Hotel Syracuse, Syracuse, N. Y.

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Domestic Production and Sales of Plastics and Resin Material, February and March, 1960

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of February and March, 1960. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	February, 1960		March, 1960	
	Production	Sales	Production	Sales
Cellulose Plastics:				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,272,383	1,365,356	1,622,970	1,736,488
Sheets, 0.003 gage and over	1,598,239	1,610,949	2,046,348	1,987,503
All other sheets, rods, and tubes (including other cellulose plastics)	818,681	884,536	1,033,575	1,044,176
Molding and extrusion materials (including other cellulose plastics)	8,256,662	8,099,421	9,611,323	8,826,885
Nitrocellulose sheets, rods, and tubes	231,569	125,375	249,294	144,464
TOTAL	12,177,534	12,085,637	14,603,510	13,739,516
Phenolic and Other Tar-Acid Resins:				
Molding materials	20,429,113	16,776,239	22,146,677	18,189,140
Bonding and adhesive resins for—				
Laminating (except plywood)	6,311,765	4,199,804	6,462,038	3,929,619
Coated and bonded abrasives	1,616,061	1,348,517	1,799,585	1,609,580
Friction materials (brake linings, clutch facings, and similar materials)	1,429,527	1,175,906	1,489,685	1,024,507
Thermal insulation (fiber glass, rock wool)	3,552,607	3,469,834	3,573,805	3,562,864
Plywood	5,484,435	4,897,466	4,788,845	3,504,800
All other bonding and adhesive uses	5,701,675	6,658,663	6,243,726	5,830,803
Protective-coating resins unmodified and modified except by rosin	2,440,370	1,931,613	3,071,339	2,075,352
Resins for all other uses	4,284,771	3,796,976	5,015,933	3,809,798
TOTAL	51,250,324	44,255,018	54,581,633	43,536,463
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,466,644	2,711,946	3,042,044	2,815,680
Paper-treating and paper-coating resins	2,531,555	2,285,222	2,749,158	2,427,310
Bonding and adhesive resins for—				
Laminating	3,270,182	2,525,305	3,124,793	2,514,582
Plywood	8,499,333	8,881,705	8,801,462	8,906,454
All other bonding and adhesive uses	1,382,294	1,638,094	1,722,055	1,741,363
Protective-coating resins, straight and modified	3,331,281	2,469,637	2,538,090	2,581,633
Resins for all other uses, including molding	10,959,744	10,759,645	12,136,267	11,257,429
TOTAL	32,441,033	31,316,554	34,113,869	32,244,451
Styrene Resins:				
Molding and extrusion materials:				
Straight polystyrene	21,297,975	20,067,417	25,573,505	21,811,561
All other	32,237,082	26,654,149	31,874,094	27,804,980
Protective-coatings	6,059,179	5,537,155	6,686,636	6,302,197
Textile and paper treating and coating resins	5,401,076	4,432,932	6,140,106	4,798,707
All other uses	14,522,455	18,533,235	15,848,736	21,554,755
TOTAL	79,607,767	75,224,888	86,123,077	82,272,200
Vinyl and Vinyl Chloride Resins:				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		9,044,419		9,105,658
Sheeting (resin content)		10,381,577		10,293,914
Molding and extrusion (resin content)		24,234,098		25,662,952
Textile and paper treating and coating (resin content)		5,019,054		5,126,631
Flooring (resin content)		13,721,632		14,717,930
Protective coating (resin content)		2,601,714		3,171,370
All other uses (resin content)		7,584,981		9,509,584
All other vinyl resins for—				
Adhesives (resin content)		4,810,963		6,149,273
Protective coatings (resin content)		1,929,497		2,386,795
All other uses (resin content)		11,919,120		12,264,889
TOTAL	101,254,980	91,247,055	108,263,145	98,388,996
Coumarone-Indene and Petroleum Polymer Resins	19,393,879	20,078,448	19,993,248	20,717,626
Polyester Resins:				
For reinforced plastics	12,142,406	11,402,529	14,141,447	11,975,231
For all other uses	2,317,483	1,975,677	2,293,760	2,356,098
TOTAL	14,459,889	13,378,206	16,435,107	14,331,329
Polyethylene Resins:				
For film and sheeting		31,728,541		30,706,640
Molding materials		14,964,131		14,890,133
Extrusion materials		12,597,557		13,539,626
For all other uses		36,045,198		41,633,017
TOTAL	105,663,437	95,335,427	114,565,508[1]	100,769,416
Epoxy Resins:				
For protective coatings		1,890,241		1,967,932
For all other uses		2,329,181		2,295,224
TOTAL	4,857,463	4,219,422	5,325,970	4,263,156
Miscellaneous Synthetic Plastics and Resin Materials, Including Silicone Resins	24,714,504	21,683,929	25,905,929	22,744,297
GRAND TOTALS	445,838,810	484,081,563	479,910,668	433,007,450

[1] 15.1% produced by the low-pressure process.
[2] 13.0% produced by the low-pressure process.
SOURCE: United States Tariff Commission, Chemical Division.

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Another new development using

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